

GEOLOGICAL SURVEY OF CANADA
GEORGE M. DAWSON, C.M.G., LL.D., F.R.S., DIRECTOR

CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.

PALEONTOLOGIST AND ZOOLOGIST TO THE SURVEY

PART V., and Last

7. *On some additional or imperfectly understood fossils from the Hamilton formation of Ontario, with a revised list of the species therefrom*

(WITH GENERAL TITLE PAGE, LETTER OF TRANSMITTAL, APPENDIX AND INDEX)



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VOLUME I.

BY J. F. WHITEAVES.

7. *On some additional or imperfectly understood fossils from the Hamilton formation of Ontario, with a revised list of the species therefrom.*

The second paper in this volume, on the fossils of the Hamilton formation of Ontario, was based upon all the specimens that the writer had seen, and upon all the information on the subject that was available up to the close of 1886. In that paper, the names of the earliest collectors of the fossils of these rocks and the dates at which the collections were made, were inadvertently omitted. All the authentic information on these points that the writer has been able to gather, is as follows:—

1855. Alexander Murray and James Hall collected fossils together at Widder and along the Rivière aux Sables at Bartlett's Mills, and elsewhere, in 1855, as stated in Murray's Report for that year and verbally by Professor Hall to the writer in the spring of 1890.

1868. Numerous fossils in the Museum of the Survey are labelled "Hamilton formation, Bosanquet, J. Pettit, 1868."

1873-74. Professor H. A. Nicholson (in a letter dated March 7, 1898) says that his collecting near Widder and Arkona was carried on principally, if not entirely, during the years 1873 and 1874.

1872-79. Dr. G. J. Hinde (in a letter dated February 5, 1898) says that he collected fossils at Thedford (Widder) and the neighbourhood for the seven consecutive years from 1872 to 1879, both years inclusive.

Since this paper was written, the publication of several monographs on special groups of fossils has thrown new light upon this local fossil fauna, and much additional material has been accumulated by local collectors. During three visits to Thedford, in 1889, 1891 and 1897, the writer has not only collected the fossils of that neighbourhood (inclusive of Bartlett's Mills) but also made careful examinations of the collections made by the Rev. Hector Currie, and more recently by Mr. G. Kernahan and Mr. N. J. Kearney, of Thedford. These gentlemen have kindly lent to the writer most of the choicest specimens that they have obtained up to the present

date and have presented many of them to the Museum of the Survey. Mr. Charles Schuchert, who made an unusually large collection of the fossils of the Thedford district in 1895 for the United States National Museum, has favoured the writer with a most accurate list of all the species that he obtained on this occasion, and generously supplemented it with a loan of specimens of forty-five of the species, for examination and comparison. Exclusive of some undetermined and possibly undescribed polyzoa (bryozoa), Mr. Schuchert's list, which, with his permission, has been freely used in the preparation of this paper, includes the names of about thirty species that had not previously been found in this formation in Canada. Mr. B. E. Walker, of Toronto, who made a collection of the fossils of the Thedford district in 1896, has also given the writer every facility for examining his specimens and has lent many of them for further study and comparison. To each of these obliging friends the writer's thanks are due and are here very cordially tendered.

The present paper is a succinct statement of the results of a detailed study of this new material and of additional studies of all the specimens from this formation and province, in the Museum of the Survey. In connection therewith, the writer desires to express his obligations to Mr. Schuchert for several critical suggestions; to Mr. L. M. Lambe for valuable assistance in ascertaining the minute characters of several species and in checking off measurements; to the late Dr. S. A. Miller (of Cincinnati) for comparing specimens of two species of *Dolatocrinus* with the types of the species described by him, in connection with Dr. Gurley; and to Mr. Victor W. Lyon (of Jeffersonville, Indiana) for the comparison of two specimens with the types of *Megistocrinus rugosus* in his possession, and for the use of an original drawing or diagram of the plates composing the dorsal cup and tegmen of that species, by his father, the late Major Sidney S. Lyon.

CELEENTERATA.

SPONGIÆ.

ASTREOSPONGIA HAMILTONENSIS, Meek and Worthen.

Astreospongia Hamiltonensis, Meek and Worthen. 1866. Proc. Chicago Acad. Sc., vol. I., p. 12; and (1868) Geol. Surv. Illinois, vol. III., p. 419, pl. 10, fig. 6.
Whiteaves. 1891. This volume, pt. 3, p. 198, pl. 28, figs. 1 and 1a.

Separate six rayed spicules, which appear to be referable to this species, have been found at Thedford and Bartlett's Mills, as stated elsewhere (*op. cit.*, p. 198) in this volume.

SUPPOSED BUNDLES OF SPICULES.

Two specimens, which Mr. Schuchert thinks are "anchoring bundles of spicules," were collected by him, in 1895, in the "Middle third of the section" at Thedford. Both are No. 26,462 of the United States National Museum Catalogue of Invertebrate Fossils. The more perfect of the two is a bundle of extremely slender and apparently simple spicules, upwards of an inch in length, forming a nearly cylindrical, narrow and densely aggregated mass at one end, but flattened, spreading and moderately expanded at the other.

SUPPOSED CLIONA BORINGS.

Twelve specimens of *Spirifera pennata*, Atwater (= *S. mucronata*, Conrad) collected by Mr. Schuchert from the "Upper third of the section" at Thedford, show peculiar markings which he thinks are "Cliona borings." For the greater part of their length these markings are rather minute grooves than burrows, but this circumstance is probably due to the exfoliation of the outer layer of the test of each of the Spirifers. These twelve specimens are No. 26,463 of the United States National Museum Catalogue of Invertebrate Fossils.

ANTHOZOA.

ALCYONARIA.

AULOPORA SERPENS (Goldfuss) Rominger.

Aulopora serpens (Goldfuss) Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 86, pl. 33, fig. 2.

Numerous specimens of a creeping, parasitic, auloporoid coral, which Mr. Schuchert has identified with this species, and which certainly agree very well with Rominger's description and figures of it, have been collected near Thedford and at Bartlett's Mills. Mr. Lambe, however, thinks that these specimens are merely young colonies of a species of *Syringopora*, and it is obvious that their internal structure is essentially as in that genus.

In his first report on the Palaeontology of the Province of Ontario, Professor Nicholson refers a coral, which he says is "common in the Hamilton formation of the Township of Bosanquet, adhering to brachiopods and corals,"—to the *Aulopora cornuta* of Billings. Upon the strength of this identification the name of *A. cornuta* was inserted in a previous list of the fossils of this formation. But the types of *A. cornuta* are from the Corniferous limestone, and Mr. Lambe, who has recently studied their

internal structure, is of the opinion that they are only parts of the basal reticulation of specimens of *Syringopora Maclurei*, Billings.

Mr. Schuchert also identifies two creeping attached corals that he collected at Bartlett's Mills, with the *Aulopora procumbens* of Davis, which is figured on Plate 73 of "Kentucky Fossils Corals." But that species has never been described, and there is nothing to show what its internal structure is like.

MONILOPORA ANTIQUA. (N. Sp.)

Plate 48, figs. 1, 2, 3 and 3a.

Corallum compound, at first attached to and either wholly or partially encircling foreign bodies, but apparently free and ramose ultimately. Most of the specimens that the writer has seen are parasitic on portions of the columns of crinoids, in some cases (as in fig. 1) completely enveloping them, except at the ends, and throwing out corallites in every direction; in others (as in fig. 2) only partially attached and spreading out into a thin, nearly flat, sub-circular lateral expansion, with all the corallites springing from its upper surface, and the lower surface consisting of a concentrically wrinkled epitheca. In this state of preservation the corallites are numerous, tubular, or somewhat conical and widening slightly outward, rather short, simple, bifurcate, trifurcate, or twice bifurcate, very unequal in size, the larger ones averaging about four millimetres in diameter at their summits. In two or three fragments, however, the most perfect of which is represented by figure 3, the branches are entirely free, and zigzag, with alternating corallites. In all the specimens the calyces are deep, the septa are almost obsolete and represented only by a faint minute longitudinal grooving of the inner surface of the calyx, and the upper or outer edges of the calyces are thin and finely denticulated by the minute longitudinal channelling of the exterior of the summits of the corallites.

Except upon the basal epitheca of laterally expanded specimens, the whole of the surface is minutely granulo-striate and marked by irregularly disposed and very minute granules, tubercles, or low, interrupted longitudinal ridges, with equally minute grooves or channels between them.

A longitudinal section of a portion of a free branch, which is bifurcate above, shows that the branch is hollow throughout its length, and quite devoid of tabulae or of funnel-shaped diaphragms. The wall is rather thin, but no thin microscopic sections of any portion of it have yet been made, to show whether its structure is minutely cancellated or not.

This well-marked species appears to be not uncommon at Thedford, where specimens were collected by Mr. Johnson Pettit in 1868, by the

Rev. Hector Currie in 1880, by the Rev. J. M. Goodwillie in 1882, by Dr. H. M. Ami in 1883, and by the writer in 1889. So far as the writer is aware, it is the first species that has been recognized as occurring in rocks of Devonian age. It is easily distinguished by its very peculiar surface ornamentation, which, although rather difficult to describe adequately in words, is well shown by figure 3a.

ZOANTHARIA.

(Tetracoralla, Heckel : = Rugosa, Edwards and Haime.)

HELIOPHYLLUM JUVENE, Rominger. (Sp.)

Cyathophyllum juvene, Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 100, pl. 35, upper row, the three smaller specimens on the right side of the plate.

Heliophyllum juvene, Calvin. 1888. Amer. Geologist, vol. I., p. 83.

"Widder, Canada West." "A very constant form found in association with *Heliophyllum Halli*, resembling it in all particulars, but in all proportions smaller." Rominger. The figures of these two forms, in the Fossil Corals of Michigan, do not impress one with their distinctness. Professor Calvin says (*op. cit.*) that *H. juvene* is found in the "Middle division of the Hamilton group on the Rivière aux Sables."

BLOTHROPHYLLUM CONATUM, Hall. (Sp.)

Cyathophyllum conatum, Hall. 1876. Illustr. Devonian Foss., pl. 31, figs. 1-14.

Mr. Schuchert has collected several specimens of a coral, which he has identified with this species and referred to the genus *Blothrophyllum*, from the "Middle third of the section," near Thedford and at Bartlett's Mills. These are No. 26,603 of the United States National Museum Catalogue of Invertebrate Fossils.

PHILLIPASTREA VERNEULI, Edwards and Haime.

Phillipastrea Verneuli, Edw. and Haime. 1851. Mon. Polyp. Foss. Terr. Palæoz., p. 447, pl. 10, fig. 5.

" " Billings. 1859. Canad. Journ., N. S., vol. IV., p. 127, fig. 34

" " Billings. 1863. Geol. Canada, p. 365, fig. 363.

In 1895 Mr. Schuchert succeeded in finding one good specimen of this species, which is so common in the Corniferous limestone of Ontario, in the "Middle third of the section" at Bartlett's Mills.

CYSTIPHYLLUM CONIFOLLE, Hall.

Cystiphyllum conifolius, Hall. 1876. Illustr. Devonian Foss., pl. 30, figs. 3-9.

"Town" (evidently a typographical error for township) "of Bosanquet." Hall, 1876. Thedford and Bartlett's Mills, in the "Middle third of the section"; C. Schuchert, 1895. Perhaps only a variety of *C. americanum*, Edwards and Haime.

(Hexacoralla, Hæc = Tabulata, Edwards and Haime.)

FAVOSITES ALPENENSIS, Winchell.

Favosites Alpenensis, Winchell. 1866. Rep. Lower Penins. Mich., p. 88.

Favosites Hamiltonensis, Rominger (Pars). 1876. Geol. Surv. Mich., Fossil Corals, p. 27, pl. 7, fig. 3.

Favosites Gothlandica, (Lamarck). Var. Whiteaves. 1892. This vol., pt. 4, p. 272.

Mr. Schuchert has identified with this species three specimens of a coral which he collected in 1895 from the "Middle third of the section" near Thedford. These specimens, which the writer has examined, are evidently conspecific with the coral from lakes Manitoba and Winnipegosis referred to on page 272 of the fourth part of this volume as a variety of *Favosites Gothlandica*, Lamarck. The latter determination was based upon the largely extended definitions of the characters of *F. Gothlandica*, by E. Billings and Prof. H. A. Nicholson, and more particularly on Mr. Billings's statements that the size of the tubes in the corals which he refers to that species, "ranges from three-fourths of a line to a little more than two lines,"*, and that "the spiniform rays (or septa) exist in both upper Silurian and Devonian specimens of *Favosites*."†

It is not clear to the writer why Dr. Rominger, in his monograph of the fossil corals of Michigan, proposes to substitute the new name *Favosites Hamiltonensis* for the *F. Alpenensis* and *F. dumosus* of Winchell.

FAVOSITES ARBUSCULA, Hall.

Favosites arbuscula, Hall. 1876. Illustr. Devonian Fossils, pl. 36, figs. 1-9.

" " Calvin. 1888. Amer. Geologist, vol. X., p. 83.

A common branching species, which was first recognized as occurring in the Hamilton formation of Ontario by Professor S. Calvin. So far, it has been found only in the "Middle third of the section," near Thedford, and at Bartlett's Mills, where numerous specimens were collected by Mr. Schuchert in 1895. The list of fossils of the Hamilton formation

* Canadian Journal, New Series, vol. IV., p. 102.

† On the same page of the same publication.

of Ontario in the fifteenth chapter of the "Geology of Canada," contains the names of *Favosites Gothlandica*, *F. turbinata*, *F. polymorpha*, *F. cervicornis* and *F. hemispherica*. New specific names have since been proposed for three of these, and it is now apparent to the writer that the *F. Gothlandica* of this list is *F. Billingsii*, Rominger; that the *F. polymorpha* is *F. clausa*, Rominger; and the *F. cervicornis*,—*F. arbuscula*, Hall.

RHEMERIA RAMOSA. (N. Sp.)

Plate 48, figs. 4 and 5.

Corallum compound, in the few specimens which the writer has seen, which appear to be terminal branchlets of ramose colonies, either club-shaped and slightly compressed, or fan-shaped, strongly compressed and somewhat lobate above, more or less branched, in all cases erect and usually widening toward the summit. Corallites simple, short, tubular and slightly expanding, but closely amalgamated at the sides, radiating from an imaginary median axis, but appressed and very slightly divergent, their apertures directed outward and upward, all, but a few terminal ones, opening at the sides. Calyces deep, septa rudimentary, almost obsolete, apparently represented by numerous minute isolated tubercles, or possibly spine bases, with which their inner surface is strewn. Apertures of the calyces variable in outline, but mostly subovate or almost circular, the larger ones averaging from four to five millimetres in their longer diameter. Mural pores rather large and irregularly disposed.

Surface nearly smooth, but marked with a few faint transverse striae of growth, which are scarcely visible without the aid of a lens. Where portions of the surface were rubbed down to show the internal structure, there are indications of funnel-shaped diaphragms immediately below the calyces.

The writer has seen only four specimens of this species, all of which are now in the Museum of the Survey. Two of these were collected by Mr. Townsend and are labelled by him, Township of Bosanquet; one was found by Mr. Kernahan, at Thedford; and one by the Rev. Hector Currie, at Stony Point, four miles east of Kettle Point, Lake Huron. It is just possible that these specimens should be referred to *Vermipora*, Hall, as redescribed by Rominger on pages 68 and 69 of his Fossil Corals of Michigan, but in *Vermipora* the transverse diaphragms or tabulae are said to be flat. All four show the "intercalation of new tubes by lateral gemmation," which is one of the characters of Rominger's *V. fasciculata*.

HYDROMEDUSÆ.

HYDROIDA.

CLATHRODICTYON RETIFORME, Nicholson and Murie. (Sp.)

Stylodictyon retiforme, Nicholson and Murie. 1878. Journ. Linn. Soc., Zoology, vol. XIV., p. 222, pl. 2, fig. 14, and pl. 3, figs. 1-3.

Clathrodiction retiforme, Nicholson. 1887. Ann. and Mag. Nat. Hist., Ser. 5, vol. XIX p. 13, pl. 3, figs. 6-8.

"Rare in the Hamilton formation (Devonian) at Arkona, Ontario," where it was discovered by Dr. G. J. Hinde. Nicholson.

STROMATOPORA MAMILLATA, Nicholson.

Stromatopora mamillata, Nicholson. 1873. Ann. and Mag. Nat. Hist., Ser. 4, vol. XII., p. 94, pl. 4, fig. 4; and (1874) Rep. Pal. Prov. Ontario, p. 17, pl. 1, fig. 4.

Mr. Schuchert refers to this species a few good specimens that he collected from the "Middle third of the section" at Bartlett's Mills, and that are No. 26,596 of the United States National Museum Catalogue of Invertebrate Fossils. It is to be observed, however, that the types of *S. mamillata* are from the Corniferous limestone, that they have not yet been examined microscopically, and that no microscopic sections have been made of any of Mr. Schuchert's specimens.

STROMATOPORELLA INCRUSTANS, Hall and Whitfield. (Sp.)

Stromatopora (Ctenostroma) incrustans, Hall and Whitfield. 1873. Twenty-third Rep. N.Y. St. Cab. Nat. Hist., p. 227, pl. 9, fig. 3.

Stromatopora nulliporoides, Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 78.

Stromatoporella incrustans, Nicholson. 1891. Ann. and Mag. Nat. Hist., Ser. 6, vol. VII., pp. 309 and 310, foot note.

"Hamilton formation; Arkona. Also in the Corniferous Limestone, Port Colborne." Nicholson. The species is abundant in the neighbourhood of Thedford.

ECHINODERMATA.

CRINOIDEA.

GILBERTOCRINUS SPINIGERUS, Hall. (Sp.)

Trematocrinus spinigerus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 128.

Goniasteroidocrinus spinigerus, Meek and Worthen. 1866. Geol. Surv. Illinois, vol. II., p. 222.

" " S. A. Miller. 1877. Cat. Amer. Palæoz. Fossils, p. 80.

- Ollacrinus spinigerus*, Wachsmuth and Springer. 1881. Rev. Paleocrinoidea, pt. 2, p. 215.
 " " Whiteaves. 1887. This volume, pt. 2, (advance sheets) p. 103; and (1889) pl. 13, figs. 4, 4, a-b.
Goniasteroidocrinus spinigerus, S. A. Miller. 1889. N. Amer. Geol. and Paleont., p. 250.
Gilbertocrinus spinigerus, Wachsmuth and Springer. 1897. N. Amer. Crinoidea Cameraata, vol. I., p. 247, pl. 15, figs. 3, a-c.

In the volume last cited, the generic name *Ollacrinus* (Cumberland, 1826) is rejected for this and other species, on the ground that it "cannot be looked upon as lawfully published," and the name *Gilbertocrinus* (Phillips, 1836) adopted instead.

DOLATOCRINUS CANADENSIS, Whiteaves.

- Dolatocrinus Canadensis*, Whiteaves. 1887. This vol., pt. 2, (advance sheets) p. 99; & (1889) pl. 12, figs. 3 & 3 a.
 " " Wachsmuth and Springer. 1897. N. Am. Crinoidea Cameraata, vol. I., p. 315, pl. 25, figs. 7, a-b.

This crinoid, which has three primary arms in each ray, has recently been redescribed and refigured in the beautifully illustrated monograph by Wachsmuth and Springer quoted above. The species would appear to be rare, as the specimen from Thedford figured on Plate 12 of this volume is still the only one that the writer has seen.

DOLATOCRINUS SUBACULEATUS. (N. Sp.)

Plate 48, figs. 6, 6 a, and 6 b.

Calyx depressed hemispherical, broader than high and flattened below, rather small for the genus, not much exceeding fifteen millimetres in maximum breadth in the few specimens that the writer has seen. Primary arms in each ray, two. Basals and lower halves of the radials deeply incurved, like those of *D. lacus*, Lyon (as recently described by Wachsmuth and Springer on pages 311 and 312 of the first volume of their monograph of the "North American Crinoidea Cameraata"), and formed, as in that species, into an "inverted funnel-shaped cavity which is wider than the column, the latter touching only the bottom part." Around the base there is a large pentagon, the outer boundary of which is formed by a narrow continuous ridge which connects the radials laterally. Each of the angles of this pentagon is intersected vertically by a linear ridge, which occupies the middle of each ray, and each side of this pentagon forms the base of a triangle, the apex of which is the centre of the first interbrachial. The linear ridge along the median line of each ray is prominent, acute, and bears two laterally compressed, rather

obtusely pointed tubercles, one at the midheight of the ray and in the centre of the first costal, and one at the point of bifurcation of the ray and in the centre of the second costal. The first interbrachials are ornamented with a large, prominent, upward pointed tubercle in the centre, with linear ridges radiating from it, and the tegmen with numerous, very small tubercles.

Basals small, inverted: radials hexagonal, broader than high: first costals quadrangular, also broader than high: second costals pentangular and much broader than high: distichals 1×2 . A respiratory, slit-like opening on one side only of each arm base, and hence ten in all, each opening linear, well defined, placed close to and parallel with the ambulacral furrow. First interbrachials single and very large: second interbrachials also single, pentagonal and bent abruptly inward at their midheight. Tegmen composed of rather numerous large plates, the anal tube subcentral and rising gradually therefrom.

The foregoing description is based upon three well preserved and nearly perfect specimens of the calyx, one collected at Bartlett's Mills by the Rev. J. M. Goodwillie in 1882 and presented by him to the Museum of the Survey, and two found quite recently at Thedford by Messrs. Kernahan and Kearney. The first of these is the specimen referred to on page 98 of the second part of this volume and identified with *D. viratus* (Hall), on the authority of Mr. Wachsmuth, who thought that it might be a small form of that species, although it has "only 1×2 secondary radials." In view of the more detailed and illustrated description of *D. viratus* published by Wachsmuth and Springer, this identification seems to be no longer tenable, and the three specimens now under consideration more probably represent a small, strongly and very peculiarly sculptured, ten-armed and previously undescribed species, perhaps most nearly allied to *D. pulchellus* of Miller and Gurley, which, however, has a respiratory slit on both sides of each arm base, or twenty slits in all. Dr. S. A. Miller, who has kindly examined one of these specimens, regards it as quite distinct from *D. pulchellus*, and from any species known to him.

DOLATOCRINUS. (N. Sp.)

A single specimen of the calyx of a large *Dolatocrinus* which has a different arm formula to either of the two preceding species, and which is therefore presumably distinct from both, was collected at Thedford by the Rev. Hector Currie in 1882. On the authority of Mr. Wachsmuth, who thought that it has four primary arms in each ray, this specimen was identified with *D. lamellosus*, the *Cacabocrinus lamellosus* of Hall, on page 99 of the second part of this volume. But, in the first volume of their monograph of the American Crinoidea Camerata, published in 1897,

(page 311), Messrs. Wachsmuth and Springer say that they have been unable to get authentic specimens of Hall's *Cacabocrinus lamellosus* and *C. Troostii*, and that the descriptions of them are too general for specific determination. Moreover, the original types of *C. lamellosus* are stated by Hall to be from the Upper Helderberg limestone.

Dr. S. A. Miller, who has examined this specimen also, has convinced the writer that it really has seventeen arms, its arm formula being $4 + 3 + 3 + 3 + 4 = 17$, and thinks that it should be regarded as the type of a new species. It is, however, unfortunately too imperfect to admit of a satisfactory description of its characters, although previously but incorrectly represented as "nearly perfect," when most of its surface was covered by the matrix.

DOLATOCRINUS. (Species uncertain.)

Perhaps a var. of *D. tuberculatus*, Wachsmuth and Springer.

Cfr. *Dolatocrinus tuberculatus*, Wachsmuth and Springer. 1897. N. Amer. Crinoidea Camerata, vol. I., p. 324, pl. 25, fig. 3.

A single specimen of a large *Dolatocrinus* with a surface ornamentation differing materially from that of the preceding species, but which does not show the arm formulae, was collected at Thedford by Mr. Kearney in 1895 and is now in the Museum of the Survey. The dorsal cup of this specimen is apparently similar to that of *D. tuberculatus* in size, shape and sculpture, but the prominent circular rim at the base, which encircles the upper part of the column, is proportionately larger and thicker, so that the five large pointed tubercles which surround it, almost touch its outer edge and are not placed at some distance from it. In the type of *D. tuberculatus*, as figured in the monograph cited, the basal rim is about six millimetres and a half in its maximum diameter and the summits of the five large tubercles nearest to it are about five mm. from its outer margin. The basal rim of the Thedford specimen is fully ten mm. in diameter and the summits of the five large tubercles nearest to it are not more than two mm. from its outer margin. Although the external sculpture of this specimen is well preserved, the sutures between the plates of which the dorsal cup is composed are entirely covered by the matrix, so that it is not yet practicable to compare the number and relative shape of these plates with those of *D. tuberculatus*.

Nothing is known of the ventral disk or arms of that species, and of the Thedford specimen all that is preserved is a large portion of the dorsal cup, with most of the upper part of one of the rays. On the left side of this ray there was clearly one arm, but on the right side it is scarcely practicable to decide whether there was one arm or whether there were two.

MEGISTOCRINUS RUGOSUS, Lyon and Casseday.

- Megistocrinus rugosus*, Lyon and Casseday. 1859. Am. Journ. Sc. and Arts, ser. 2, vol. XXVIII., p. 243.
 " " Whiteaves. 1887. This volume, pt. 2 (advance sheets) p. 101,
 " " Wachsmuth and Springer. 1897. N. Amer. Crinoidea Camerata, vol. II., p. 542, pl. 48, figs. 6, a-c.

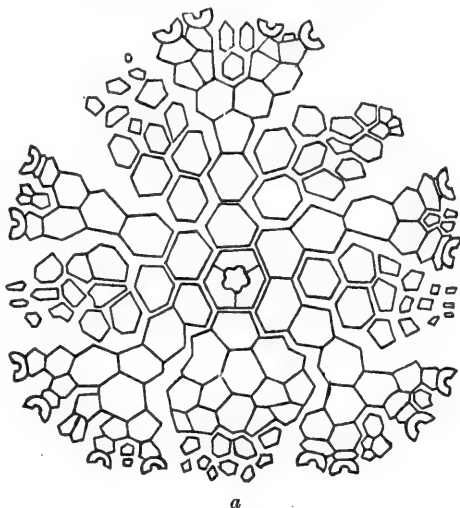


Fig. 1. *Megistocrinus rugosus*. Diagram of the plates composing the dorsal cup and tegmen of one of the type specimens of this species, from Louisville, Kentucky. From an original drawing by the late Major Sidney S. Lyon, lent by Mr. Victor W. Lyon. a. Anal side.

A small specimen, which was regarded by Mr. Wachsmuth as a young individual of this species, was collected near Thedford by the Rev. J. M. Goodwillie in 1882, and presented by him to the Museum of the Survey. A similar, but much larger and in some respects better preserved specimen, was picked up in the Rivière aux Sables, near Thedford, in 1891, by Mr. G. H. Stone (of Almont, Michigan), who has also presented it to the Museum of the Survey. Both of these specimens have been sent to Mr. Victor W. Lyon, of Jeffersonville, Indiana, for comparison with the types of *M. rugosus* in his possession, and in regard to the former Mr. Lyon writes as follows, in a letter dated Nov. 5, 1897:—"I have compared the two Canadian crinoids with type specimens of *Megistocrinus rugosus*,

Lyon and Casseday, and find that your specimens are young specimens of that species. All *M. rugosus* that I have seen have sixteen arms. The larger one you sent has sixteen arms, and the shape and ornamental markings are identical with the type specimens, although somewhat worn. The markings on the smaller one are more distinct, but the basal plates do not show so well as in the larger one. Both are true *Megistocrinus rugosus*. I am obliged to you for sending these two crinoids, for I know now that *M. rugosus* has an extended distribution."

The original types of *M. rugosus* are from the "quarries at Bear Grass Creek, near Louisville, Kentucky," though Clarke County, Indiana, is the first locality indicated for this species by Wachsmuth and Springer (*op. cit.*, p. 543).

GENNÆOCRINUS ARKONENSIS. (N. Sp.)

Plate 48, figs. 7 and 7a, and the accompanying cut.

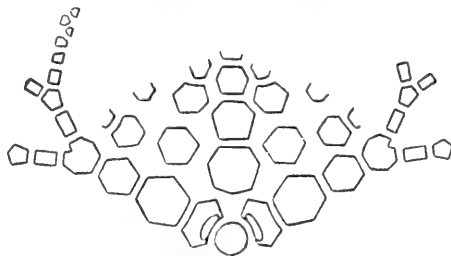


Fig. 2. *Gennæocrinus Arkonensis*. Diagram of all the plates of the dorsal cup that are visible in the specimen figured on Plate 48, with some of those at the commencement of the arms. Three times the natural size.

Calyx unusually small for the genus, the most perfect specimen known (the one figured) being about ten millimetres in its maximum breadth, though slightly and abnormally compressed, and a little broader than high: arms very long in proportion to the size of the calyx, pinnules also long, numerous and densely crowded. Dorsal cup semiglobose, cup-shaped, widening gradually upward and widest above, its surface markings very faint and indistinctly defined. In the median line of the radial and first costal each ray is marked by an obscure, low, rounded, longitudinal ridge, which bifurcates in the upper portion of the second costal. The surface of the lower and larger plates also, especially that of the radials and first "interbrachials," is marked with six or seven obscure, low, depressed-convex, radiating ridges near their outer margin, the central portion being entire and either smooth or occasionally bearing a

minute tubercle. All the interbrachials, except the first, appear to be nearly or quite smooth.

Basals three, hexagonal, rather more than twice as broad as high, slightly concave at their lower margin, which is thickened and projects outward in such a way as to form a narrow elevated rim. Radials and costals as high as broad, the radials and first costals hexagonal, the second costals heptagonal, but with an angular notch in the upper margin, between the two surfaces which articulate with the bases of each pair of primary distichals. Distichals 2×10 : primary distichals rectangular and higher than wide, secondary distichals pentagonal: palmars rectangular, nearly square: arms biserial and apparently eight in each ray. "Interbrachials" 1, 3, 5 (though the plates in this genus which Wachsmuth and Springer call the first interbrachials seem to the writer to be true interradians), the first large and heptagonal, the others hexagonal, decreasing slowly in size upward and succeeded by a row of about seven smaller plates. Characters of the tegmen unknown.

Column long, slender, in some cases apparently adherent to foreign bodies by a small, thin, laterally expanded base of attachment: its segments cylindrical or slightly swollen in the middle externally, circular in section, uniform in breadth and distinctly crenulated on both of their articulating faces.

Good fragments of the arms and pinnules of this crinoid are not rare at Bartlett's Mills, but the only specimens with the dorsal cup preserved that the writer has seen are two collected at that locality by Mr. Kearney, one in 1895, and the other in 1896. The one collected in 1895, which has been kindly lent by Mr. Schuchert, belongs to the United States National Museum, and is No. 26,470 of its Catalogue of Invertebrate Fossils, and the one collected in 1896, which is figured on Plate 48, is now in the Museum of the Survey. Both of them have the whole of one side of the dorsal cup buried in the matrix. The specimen figured shows, on one side, two rays and a considerable portion of their arms and pinnules *in situ*, with the interradian or "interbrachial" plates between them, and a detached portion of the column;—and on, the other, a beautifully preserved aggregation of arms and pinnules, with another small piece of the column. In a specimen from Thedford, which consists of the two posterior segments of the column only, and which seems to be referable to this species, the terminal segment is attached to a flattened branching polyzoon by a thin lateral expansion.

An apparently well marked species, characterized by its small dorsal cup, slender column, and, more especially, by its very feeble and almost obsolete surface markings.

BOTRYOCRINUS CRASSUS, Whiteaves.

Homocrinus crassus, Whiteaves. 1887. This volume, pt. 2, (advance sheets), p. 95; and (1889,) pl. 12, fig. 2.

In regard to this species Mr. F. A. Bather makes the following remarks, on page 103 of his "Crinoidea of Gotland": "This is founded on a dorsal cup from the Hamilton group, which cannot be distinguished from that of a *Botryocrinus*. The posterior side of the cup is not shown in the figure, but Mr. Whiteaves has very kindly sent me the type specimen, the evidence of which is quite clear."

ANCYROCRINUS BULBOSUS, Hall.

Plate 48, figs. 8 and 9.

Ancyrocrinus bulbosus, Hall. 1862. Fifteenth Rep. N.Y. St. Cab. Nat. Hist., p. 118, pl. 1, figs. 25 and 26.

" " Whiteaves. 1887. This vol., p. 2, (advance sheets) p. 103; and (1889,) pl. 13, fig. 5.

Numerous specimens of the anchorlike posterior extremity of the column of crinoids, which seem to agree in all essential particulars with Professor Hall's description and figures of *A. bulbosus*, were collected at Stony Point, Lake Huron, a few years ago, by the Rev. Hector Currie, who has presented four of them to the Museum of the Survey. Each of these specimens has four strongly developed "obliquely ascending, spine-like processes," or "lateral extensions," which are rarely less than a quarter of an inch and sometimes fully half an inch in length, when unbroken. In two of the specimens these processes originate at about the same height and are arranged in a rather regular cruciform manner, but in the other two they originate at different heights and are very irregularly disposed. No tendency to become square or nearly square anteriorly is seen in any of them, although the axial canal of each is cruciform, as viewed in transverse section at the anterior end, and none show any indication of division into segments.

BLASTOIDEA.

Plate 48, figs. 8 and 9.

Pentremites Lycorias, Hall. 1863. Sixteenth Rep. N. Y. St. Cab. Nat. Hist., p. 123.

" " Calvin. 1888. American Geologist, vol. I., p. 84.

"Middle division of the Hamilton group about two miles south-west of Widder" (Thedford), Professor S. Calvin, *op. cit.* According to Etheridge and Carpenter, on page 132 of their Catalogue of the Blastoida in the Geological Department of the British Museum, this species may belong to the genus *Granatocrinus*, but it is equally probable that

it should be referred to *Mesoblastus* or *Pentremitidea*. On page 138 of that publication it is placed under the heading "Genera undetermined."

ASTEROIDEA.

PALEASTER EUCHARIS, Hall.

Paleaster eucharis, Hall. 1868. Twentieth Rep. N. Y. St. Cab. Nat. Hist., p. 330, pl. 9, figs. 3, 3*, and 4.

"At Bartlett's Mills, Mr. Kernahan found and gave me a ray of *Paleaster eucharis*, Hall. It is from the Lower third of my section." C. Schuchert, in a letter to the writer, dated July 6, 1897.

VERMES.

AUTODETUS LINDSTREMI, Clarke.

Autodetus Lindstromi, Clarke. 1894. Amer. Geologist, vol. XIII., p. 329, figs. 1, 2 and 3; p. 330, figs. 4, 5, 6; and p. 334.

Not very uncommon about Thedford, where specimens were collected many years ago by the Rev. Hector Currie, and more recently by Mr. Kernahan and Mr. Kearney. All the specimens from this locality that the writer has seen, are detached from the foreign bodies to which they were probably once attached, the scar of attachment being very small.

MOLLUSCOIDEA.

POLYZOA.

INTRAPORA COSCINIFORMIS, Nicholson. (Sp.)

Ptilodictya cocciniformis, Nicholson. 1875. Geolog. Mag., N.S., vol. II., p. 35, pl. 2, figs. 2, a-b.; and Rep. Pal. Prov. Ontario, p. 80, pl. 2, figs. 2, a-b.
Cocsinium cocciniforme, Hall. 1887. Pal. N. York, vol. VI, p. 239.
Intrapora cocciniformis, Ulrich. 1890. Geol. Surv. Illinois, vol. VII., p. 532, pl. 43, figs. 6 and 6a.

In the Museum of the Survey this species is represented by portions of zoaria collected at Thedford by the Rev. J. M. Goodwillie in 1882, and by an unusually fine specimen nearly three inches in breadth, by two inches and a-half in height, collected at or near Bartlett's Mills by Mr. Joseph Townsend in 1885.

INTRAPORA ELEGANTULA, Hall. (Sp.)

Cocsinella elegantula, Hall. 1887. Pal. N. York, vol. VI, p. 239, pl. 64, figs. 9-12.

"Hamilton group, Widder, Ontario, Canada." Hall. Ulrich, in a footnote to page 532 of the eighth volume published by the Geological Survey of Illinois, expresses the opinion that *Cocsinella* is synonymous

with *Intrapora*, and that *C. elegantula* is probably identical with *I. cosciniformis*.

COSCINIUM STRIATUM, Hall.

Coscinium striatum, Hall. 1887. Pal. N. York, vol. VI., p. 238, pl. 64, figs. 13-16.

"Hamilton group, Widder, Ontario, Canada." Hall. A well preserved and very characteristic specimen of this species, in the Museum of the Survey, was collected at the same locality by Rev. J. M. Goodwillie in 1882.

CYSTODICTYA MEEKI, Nicholson. (Sp.)

Ptilodictya Meeki, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 123; and Rep. Pal. Prov. Ontario, p. 97, and figs. 34 a-c on p. 98.

Cystodictya Meeki, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

"Rare in the Hamilton formation of Bartlett's Mills, near Arkona." Nicholson. Thedford, Rev. Hector Currie, 1882.

CYSTODICTYA INCISURATA, Hall. (Sp.)

Stictopora incisurata, Hall. 1881. Trans. Albany Inst., vol. X., p. 189.

" " " 1884. Rep. St. Geologist for 1883, p. 38.

" " " 1887. Pal. N. York, vol. VI., p. 241, pl. 60, figs. 1-18.

Cystodictya incisurata, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

Thedford, in the "Lower third of the section," three specimens (No. 26,546 of the United States National Museum Catalogue of Invertebrate Fossils) collected in 1895, and determined by Mr. Schuchert.

CYSTODICTYA RECTILINEA, Hall. (Sp.)

Stictopora rectilinea, Hall. 1887. Pal. N. York, vol. VI., p. 245, pl. 63, fig. 23.

Cystodictya rectilinea, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 492.

"Hamilton group, West Williams, Ontario, Canada." Hall.

CYSTODICTYA (?) INCRASSATA, Hall.

Stictopora incrassata, Hall. 1881. Trans. Albany Inst., vol. X., p. 190.

" " " 1884. Rep. St. Geologist for 1883, p. 47.

" " " 1887. Pal. N. York, vol. VI., p. 249, pl. 63, fig. 23.

"Hamilton group, West Williams, Province of Ontario, Canada." Hall.

SEMIOPORA BISTIGMATA, Hall.

Semiopora bistigmata, Hall. 1881. Trans. Albany Inst., vol. X., p. 193.

" " " 1884. Rep. St. Geologist for 1883, p. 51.

" " " 1887. Pal. N. York, vol. VI., p. 262, pl. 62, figs. 27-29.

"Hamilton group, West Williams, Ontario, Canada." Hall.

SCALARIPORA CANADENSIS. (N. Sp.)

Plate 48, figs. 10, 10a and 10b.

Zoarium consisting of stems that are triangular and almost equilateral in transverse section, the broadest of the three faces having a maximum diameter of about 7.5 mm., and the narrowest of 6.5 mm. Faces shallowly concave or nearly flat: angles acute, forming three sharp, prominent, and nearly straight but rather irregular, longitudinal ridges. Transverse ridges distant, nearly as far apart as the faces are broad, not continuous in either of the two fragments examined, developed (or present) on two of the faces in the longer of these fragments, and on only one face in the shorter. Whole surface celluliferous, apertures averaging from about 0.16 mm. to 0.25 mm. in diameter, usually rather more than their own diameter apart, or about equal to it in distance, subcircular, with a slightly elevated annular peristome and arranged obscurely in more or less regular diagonal rows, seven or eight in three mm. Internal structure not observed.

Thedford, G. Kernahan, 1895: two specimens, one seventeen millimetres in length and showing two transverse ridges and a partially developed intermediate one; the other a little more than ten mm. in length and showing only one transverse ridge. Both of these fragments are now in the United States National Museum, and are No. 26,544 of its Catalogue of Invertebrate Fossils. They were first referred to the genus *Scalaripora* by Mr. Schuchert, and seem to the writer to differ from *S. separata*, Ulrich, from the Hamilton formation at Thunder Bay, Michigan,* to which they seem to be most nearly related, by the much greater size of the branches, and apparently also by the irregularity and want of continuity of the transverse ridges.

STREBLOTRYPA HAMILTONENSIS, Nicholson. (Sp.)

Ceriopora (?) *Hamiltonensis*, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 161; and Rep. Pal. Prov. Ontario, p. 97, fig. 33.

Acanthoolema Hamiltonense, Hall. 1887. Pal. N. York, vol. VI., p. 191, pl. 55, figs. 18-20.

Rhombopora Hamiltonensis, Nicholson. 1889. In Nicholson and Lyddeker's *Man. Palæont.*, vol. I., p. 610, fig. 455 B; and fig. 478 on p. 632.

Streblotrypa Hamiltonensis, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 648.

A common species in the neighbourhood of Thedford.

FENESTELLA NICHOLSONI. (Nom. prov.)

Fenestella cribrosa, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 106, figs. 43, a, b. But probably not *F. cribrosa*, Hall, 1852, (Pal. N. York, vol. II., p. 166, pl. 40 D, figs. 3, a, b,)—which is from the Niagara limestone.

* Geological Survey of Illinois, vol. VIII., 1890, p. 507, pl. 43, fig. 3.

Not uncommon in the Hamilton Group at Widder and at Bartlett's Mills, near Arkona." Nicholson.

FENESTELLA ARKONENSIS. (Nom. prov.)

Fenestella tenuiceps, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 100, figs. 44, *a-b*.
But probably not *F. tenuiceps*, Hall, 1852 (Pal. N. York, vol. II., p. 165, pl. 40 D, figs. 2, *a, b*) which is a fossil of the Clinton and Niagara formations of the State of New York, and Ontario.

"Common in the Hamilton Formation at Bartlett's Mills, near Arkona." Nicholson.

RETEPORA PRISCA, Nicholson.

Retepora prisca (Goldfuss) Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 101, figs. 38, *a, b*.

"Common in the Corniferous Limestone of Ridgeway and Port Colborne; also in the Hamilton Group at Bartlett's Mills, near Arkona." Nicholson.

A specimen of this species, from Ridgeway, has been presented to the Museum of the Survey by Professor Nicholson, but the writer has not seen an authentically named, or very closely similar specimen from the Hamilton formation. *R. prisca*, Goldfuss, is the type of D'Orbigny's genus *Reteporina*, but Zittel, in the first volume of his Handbuch der Palaeontologie (page 600) makes both *Retepora* and *Reteporina* synonyms of *Fenestella*.

POLYPORA ARKONENSIS, S. A. Miller.

Polypora tuberculata, Nicholson. 1874. Geol. Mag., N.S., vol. I., p. 162; and Rep. Pal. Prov. Ontario, p. 100, figs. 37, *a-c*. But, according to Ulrich (Geol. Surv. Illinois, vol. VIII., p. 595) not *P. tuberculata*, Prout, 1859.
Polypora Arkonensis, S. A. Miller. 1883. Am. Paleoz. Foss., 2nd. Ed., p. 316.

Rare in the Hamilton group at Bartlett's Mills. Nicholson.

PTILOPORA STRIATA, Hall.

Ptilopora striata, Hall. 1881. Trans. Albany Inst., vol. X., p. 196.
" " " 1884. Rep. St. Geologist for 1883, p. 58.
" " " 1887. Pal. N. York, vol. VI., p. 283, pl. 66, figs. 30-33.

"West Williams, Ontario, Canada." Hall.

TREMATOPORA CARINATA, Hall.

Trematopora (Orthopora) carinata, Hall. 1887. Pal. N. York, vol. VI., p. 179, pl. 55, fig. 2; and pl. 56, fig. 3.

"Hamilton group, West Williams, Ontario, Canada." Hall.

LEIOCLEMA MINUTISSIMUM, Nicholson. (Sp.)

- Callopora minutissima*, Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 77, figs. 43, a, b.
 ? *Fistulipora minuta*, Rominger. 1890. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p. 129.
 ? *Leioclema minutum* (Rominger) Ulrich. 1890. Geol. Surv. Illinois, vol. VIII., p. 427.

Not uncommon at Bartlett's Mills. If this species be the same as the *Fistulipora minuta* of Rominger, as Ulrich thinks it may be, it of course will have to be called *Leioclema minutum*.

FISTULIPORA UTRICULUS, Rominger.

- Fistulipora utriculus*, Rominger. 1896. Proc. Ac. Nat. Sc. Philad., vol. VIII., p. 121.
 " " Nicholson & Foord. 1885. Ann. and Mag. Nat. Hist., Fifth Ser., vol. XVI., p. 508, pl. 16, figs. 1, 1, a-c; and pl. 17, figs. 1 and 1a.

Common at Thedford and Bartlett's Mills. In the Museum of the Survey there are two of the original types of the species, from "Widder," presented by Dr. Rominger; two specimens from practically the same locality, collected by Mr. Pettit in 1868; and seven specimens from Bartlett's Mills, presented by Professor H. A. Nicholson in 1890.

FISTULIPORA ROMINGERI, Nicholson & Foord.

- Fistulipora crassa*, Rominger. 1896. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p. 121. But not *Heteropora crassa*, Lonsdale. 1839 (in Murchison's Silurian System, pl. 15, figs. 14 and 14a) which Nicholson and Foord say is a *Fistulipora*.
Fistulipora Romingeri, Nicholson and Foord. 1885. Ann. and Mag. Nat. Hist., Fifth Ser., vol. XVI., p. 506.

The only authentic examples of this species in the Museum of the Survey are two of the types from "Widder" presented by Dr. Rominger.

FISTULIPORA VARIAPORA, Hall.

- Thallostigma variapora*, Hall. 1881. Trans. Albany Inst., vol. X., p. 184.
 " " " 1884. Rep. State Geol. for 1883, p. 18.
Fistulipora variapora, Hall. 1887. Pal. N. York, vol. VI., p. 210, pl. 58, figs. 9-14.
 "Hamilton group, West Williams, Ontario, Canada." Hall.

FISTULIPORA (?) SUBTILIS, Hall.

- Thallostigma subtilis*, Hall. 1881. Trans. Albany Inst., vol. X., p. 187.
 " " " 1884. Rep. State Geol. for 1883, p. 30.
Fistulipora (?) subtilis, Hall. 1887. Pal. N. York, vol. VI., p. 233. Not figured.
 "Hamilton Group, West Williams, Ontario, Canada." Hall.

LICHENALIA STELLATA, Hall.

- Lichenalia stellata*, Hall. 1881. Trans. Albany Inst., vol. X., p. 183.
 " " " 1884. Rep. State Geol. for 1883, p. 30.
 " " " 1887. Pal. N. York, vol. VI., p. 195, pl. 58, figs. 15 and 16.

Same formation and locality as for the preceding species. Hall.

In the eighth volume of the official reports of the Geological Survey of Illinois, published in 1890, Mr. Ulrich maintains that *Lichenalia*, Hall, is synonymous with *Fistulipora*. If this be the case, it of course follows that this and the two following species should be referred to *Fistulipora*. On the other hand, Mr. G. B. Simpson, in his "Handbook of the Genera of the North American Paleozoic Bryozoa," published in 1897, claims that the interperitural surface is invariably cellulose in *Fistulipora* and solid in *Lichenalia*.

LICHENALIA SUBTRIGONA, Hall.

Lichenalia subtrigona, Hall. 1887. Pal. N. York, vol. VI., p. 106. Not figured.

Hamilton group, West Williams, Ontario. Hall.

LICHENALIA RAMOSA, Hall.

Lichenalia ramosa, Hall. 1887. Pal. N. York, vol. VI., p. 109.

"Hamilton group, West Williams, Ontario." Hall.

PINACOTRYPA ELEGANS, Rominger. (Sp.)

Fistulipora elegans, Rominger. 1866. Proc. Ac. Nat. Sc. Philad., vol. XVIII., p. 121.

Fistulipora proporoidea, Nicholson. 1879. Struct. and Affin. Tabulate Corals of the Paleozoic Period, p. 310, fig. 41 (on p. 311) and pl. 15, figs. 2 and 2a; teste Ulrich.

Pinacotrypa elegans, Ulrich. 1890. Geol. Surv. Illinois, vol. VIII, p. 385.

Dr. Rominger's *Fistulipora elegans*, which Ulrich (*op. cit.*) makes the type of his genus *Pinacotrypa*, was based upon specimens from the shore of Lake Erie at Hamburg, N. Y., and from Widder. Two of the specimens from Hamburg have been presented to the Museum of the Survey by Dr. Rominger. According to Professor Nicholson (*op. cit.*) *F. proporoidea* is common in the Hamilton Group at Canandaigua, in the State of New York.

HEDERELLA CIRRHOSA, Hall.

Hederella cirrhosa, Hall. 1881. Trans. Albany Inst., vol. X., p. 194.

" " " 1884. Rep. State Geol. for 1883, p. 53.

" " " 1887. Pal. N. York, vol. VI., p. 277, pl. 65, figs. 12 and 13.

Thedford, in the "Middle third of the section," C. Schuchert, 1895: six specimens, which have been identified with this species by Mr. Schuchert. They are all adherent to corals, five to as many specimens of *Heliophyllum Halli*, and one to a broken corallite of *Crepidophyllum Archiaci*. All six are No. 26,577 of the United States National Museum Catalogue of Invertebrate Fossils.

HEDERELLA MAGNA, Hall.

- Hederella magna*, Hall. 1881. Trans. Albany Inst., vol. X., p. 195.
 " " " 1884. Rep. State Geol. for 1883, p. 55.
 " " " 1887. Pal. N. York, vol. VI., p. 280, pl. 65, fig. 15.

Thedford, in the "Middle third of the section", C. Schuchert 1895: one specimen which was collected and determined by Mr. Schuchert. It is No. 26,576 of the United States National Museum Catalogue of Invertebrate Fossils.

BRACHIOPODA.

STROPHEODONTA PLICATA, Hall.

- Strophodonta plicata*, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 90.
 " " " 1867. Pal. N. York, vol. IV., p. 114, pl. 63, figs. 30-32.
 " " " Whiteaves, 1889. This vol., pt. 2, p. 114.
 " " " Nettelroth, 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 149.
 Comp. *Strophodonta* (?) *costata*, Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa, and Minn. p. 585, pl. 3, figs. 11 & 11 a; & pl. 3 A., fig. 5.
 Comp. also *Tropidoleptus occidens*, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 91.
 " " " Hall. 1867. Pal. N. York, vol. IV., p. 408, pl. 61 A, figs. 50-52.
 " " " Hall and Clark., 1895. Pal. N. York, vol. VIII., pt. 2, pl. 82, figs. 37 & 38.

A few additional specimens of *S. plicata* have been obtained at Thedford by local collectors since 1889. It is highly probable, as suggested by Mr. Schuchert and as indicated in the foregoing synonymy, that *S. plicata* is the same shell as *S. costata*, Owen, and *Tropidoleptus occidens*, Hall. If so, the species now under consideration must of course be called *S. costata*, Owen, which was described in 1852, rather than *S. plicata*, or *T. occidens*, both of which were described eight years later. Owen's description and figures of *S. costata*, however, are very vague and unsatisfactory, being based upon a specimen only three-eighths of an inch in its greatest diameter, though it should not be forgotten that the original type of *S. plicata* is described as a "little more than half an inch in length," with the "length and width nearly equal."

PHOLIDOSTROPHIA IOWENSIS, Owen. (Sp.)

- Chonetes* (?) *Iowensis*, Owen. 1852. Rep. Geol. Surv. Wiscons., Iowa and Minn., p. 584, pl. 3 A, fig. 7.
Strophomena (*Strophodonta*) *naerea*, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 144.
Strophomena lepida, Hall. 1858. Geol. Rep. Iowa, vol. I., pt. 2, p. 493, pl. 3, figs. 3, a-c.
 " " " Billings. 1861. Journ. Canad. Inst., New Series, vol. VI., p. 344.
Strophodonta naerea, Hall. 1867. Pal. N. York, vol. IV., p. 104, pl. 18, figs. 1 a-h.

- Strophomena naerea*, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 68, and p. 69, fig. 21.
Stropheodonta (Pholidostrophia) naerea, Hall and Clarke. 1892. Pal. N. York, vol. VIII., pt. 1, p. 287, pl. 15, figs. 20-24.
Pholidostrophia iowaensis, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 308.

According to Mr. Schuchert (*op. cit. supra.*) Owen's types of *Chonetes Iowensis*, "preserved in the United States National Museum prove to be identical with *Strophomena lepida*, which Hall in 1867 said is a synonym for *Stropheodonta naerea*."

ORTHOTHETES CHEMUNGENSIS, var. ARCTOSTRIATA, Hall.

- Strophomena arctostriata*, Hall. 1842. Geol. Rep. Fourth Distr. N. York, p. 266, fig. 2.
Orthisina arctostriata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 60.
Streptorhynchus chemungensis, var. *arctostriata*, Hall. 1867. Pal. N. York, vol. IV., p. 71, pl. 9, figs. 1-12.
Orthothes chemungensis, var. *arctostriata*, Hall and Clarke. 1892. Pal. N. York, vol. VIII., pt. 1, pl. 10, fig. 8, and expl. of that plate.

Mr. Schuchert has identified with this variety of *O. Chemungensis* a few specimens which he collected in the "Upper and Lower third of the section" at Bartlett's Mills, in 1895, and since then similar specimens have been collected by Mr. Kernahan and Mr. Walker at the same locality.

ORTHOTHETES ANOMALUS, A. Winchell. (Sp.)

- Crania (Pseudocrania) anomala*, Winchell. 1866. Rep. Lower Penins. Mich., p. 92.
Pseudocrania anomala, Miller. 1889. N. Amer. Geol. and Paleont., p. 366.

Bartlett's Mills, in the "Middle third of the section," C. Schuchert, 1895: two specimens which were identified by Mr. Schuchert, and are No. 26,558 of the United States Museum Catalogue of Invertebrate Fossils.

CHONETES VICINA, Castelneau. (Sp.)

- Leptena vicina*, Castelneau. 1843. Essai sur le Syst. Silur. de l'Amér. Septentr., p. 39.
Chonetes deflecta, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 149.
Chonetes gibbosa, Hall. 1857. Ibid. p. 145.
Chonetes deflecta, Hall. 1867. Pal. N. York, vol. IV., p. 126, pl. 21, figs. 7, 8.
Chonetes vicinus, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 180.

"Thedford and Bartlett's Mills, in the Lower third of the section," C. Schuchert, 1895: several specimens, identified by Mr. Schuchert and labelled No. 25,561, United States National Museum Catalogue of Invertebrate Fossils.

Although well preserved and almost perfect specimens of *Chonetes* are abundant in the shales of the Hamilton formation at Thedford and Bartlett's Mills, the number of species of that genus that is represented in these shales is still very doubtful. E. Billings, in his paper "on the Devonian fossils of Canada West," published in 1860, identifies *Chonetes*

hemisphaerica, Hall, as occurring in the Oriskany sandstone and Corniferous limestone of Ontario, but does not attempt to determine any of the species from the Hamilton formation of that province. Professor H. A. Nicholson, in his first "Report upon the Paleontology of the Province of Ontario," published in 1874, identifies *Chonetes lineata*, (Conrad not Vanuxem) *C. scitula*, Hall, and *C. lepida*, Hall, as occurring in the Hamilton formation of that province, but thinks that *C. lepida* may be the young of *C. scitula*. It seems doubtful, also, whether the distinction between the specimens from this formation, which Nicholson refers to *C. lineata* and *C. scitula*, can be maintained. In the second part of this volume, published in 1889, (p. 113) the writer identified a specimen from Bartlett's Mills with the *C. carinata* (or *coronata*) of Conrad, and similar specimens have since been collected at that locality. Mr. Schuchert informs the writer that the species which he found at Thedford and Bartlett's Mills are *C. scitula*, *C. coronata* and *C. vicina*.

CHONETES LINEATA (?) Conrad.

Chonetes lineata, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 73.
" " Calvin. 1888. Amer. Geologist, Vol. I., p. 83.

"Abundant in the Hamilton Formation of Bartlett's Mills, near Arkona, in the Township of Bosanquet," Nicholson. "Lower division of the Hamilton Group on the Rivière aux Sables." Calvin. See the remarks upon the preceding species.

STROPHALOSIA RADICANS, A. Winchell. (Sp.)

Orania radicans, A. Winchell. 1866. Rep. Lower Penins. Mich., p. 92.
Strophalosia radicans, Beecher. 1890. Am. Journ. Sc. and Arts, Ser. 3, vol. XL., p. 243, pl. 9, figs. 14-17.

Thedford, in the "Middle third of the section", C. Schuchert, 1895: two attached valves, showing the slender processes radiating therefrom, and parasitic upon a badly preserved shell of a *Platyceras* or *Platystoma*. Identified by Mr. Schuchert, and labelled United States National Museum Catalogue of Invertebrate Fossils, No. 26,565.

STROPHALOSIA TRUNCATA (?) Hall. (Sp.)

Productella (Strophalosia) truncata (Hall) Whiteaves. 1889. This vol., pt. 2, p. 112, pl. 16, figs. 1 and 2.

A few specimens of a little spinose *Strophalosia* from Thedford and Bartlett's Mills were identified with the *Productella truncata* of Hall, in the second part of this volume, on the authority of Professor R. P. Whitfield, who had kindly compared them with authentic examples of that species. Mr. Schuchert, however, in his MSS. list of fossils from these

localities, makes the following remarks upon similar specimens collected by himself. "I believe this species to be distinct from *S. truncata*. It differs from *S. productoides* in that the dorsal valve is not spinose. *S. rockfordensis* has a lamello-se dorsal valve and is different in shape."

ORTHIS (RHIPIDOMELLA) PENELOPE, Hall.

- Orthis Penelope*, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 79, figs. 1 and 2.
 " " Hall. 1867. Pal. N. York, Vol. IV., p. 50, pl. 6, figs. 2, *a-m*.
 " " " 1883. Second Ann. Rep., N.Y. St. Geologist, pl. 36, figs. 6-13.]
Rhipidomella Penelope, Hall and Clarke. 1892. Pal. N. York, Vol. VIII., pt. I, pp. 211 and 225, pl. 6, figs. 6-13; and pl. 6 A, fig. 10 (211).

Specimens of a large *Orthis* (or *Rhipidomella*), from Bartlett's Mills and Stony Point, Lake Huron, are identified by Mr. Schuchert with Hall's *O. Penelope*, but they appear to the writer to be merely adult or large examples of *O. Vanuxemi*, Hall. *O. Penelope* is probably only a synonym of *O. Vanuxemi*, and Mr. Schuchert admits that these two forms "appear to intergrade."

PENTAMERELLA PAVILIONENSIS (?) Hall.

- Pentamerus pavilionensis*, Hall. 1860. Thirteenth Rep. N.Y. St. Cab. Nat. Hist., p. 86.
Pentamerella pavilionensis, Hall. 1867. Pal. N. York, Vol. IV., p. 377, pl. 58, figs. 28-37.
Pentamerella pavilionensis, Hall and Clarke. 1893. Pal. N. York, Vol. VIII., pt. 2, p. 245, pl. 71, figs. 30 and 31.

Six specimens which are too small or too imperfect to be determined with much certainty, but which are probably referable to this species, have recently been collected at Thedford by Mr. Kernahan. Three of these have both valves more or less well preserved, the others being imperfect single valves, but none of them show any indication of a fold or sinus. The most perfect of these specimens, which is about ten millimetres and a half in length, and twelve mm. in breadth, has about eight subangular plications on each valve, which do not reach to the beak. In a larger but very imperfect ventral valve, the plications are more feebly marked and nearly marginal, and the length is apparently a little greater than the height. Some of these specimens are very similar to the shell which Owen figures on Plate 3 A, fig. 1, of the Illustrations to his "Report of a Geological Survey of Wisconsin, Iowa and Minnesota," which Mr. Schuchert identifies with *Pentamerella dubia*, Hall, but in that species the surface is said to be "marked by from fourteen to twenty or more plications."

GYPIDULA LEVIUSCULA, Hall.

- Gypidula leviuscula*, Hall. 1867. Pal. N. York, vol. IV., p. 381, pl. 58, figs. 22 and 23.
 " " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 248, pl. 72, figs. 25 and 26.

Two specimens, which Mr. Schuchert says "differ somewhat from Iowa specimens of *G. levinscula*" in having faint indications of plications along the middle of the anterior margin, were collected by him at Thedford, in the "Middle third of the section" in 1895. They are labelled, United States National Museum Catalogue of Invertebrate Fossils, No. 26,509. A few typical examples of this species have since been collected at the same locality by Mr. Kernahan.

CAMAROTECCHIA SAPPHO, Hall.

Rhynchonella Sappho, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 87.
Rhynchonella (Stenocisma) Sappho, Hall. 1867. Pal. N. York, vol. IV., p. 340, pl. 54, figs. 33-43.

Rhynchonella Sappho, Herrick. 1888. Bull. Denison Univ., vol. III., p. 40, pl. 5, fig. 1; and pl. 7, fig. 25.

Camarotēcchia Sappho, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 192, pl. 57, figs. 10-14.

Thedford, in the "Middle third of the section," C. Schuchert, 1895: one crushed and distorted specimen, which is identified with this species by Mr. Schuchert. It is No. 26,564 of the Catalogue of Invertebrate Fossils in the United States National Museum.

CAMAROTECCHIA HORSFORDI, Hall.

Rhynchonella Horsfordi, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 87.

Rhynchonella (Stenocisma) Horsfordi, Hall. 1867. Pal. N. York, vol. IV., p. 339, pl. 54, figs. 24-32.

Camarotēcchia Horsfordi, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 192, pl. 57, figs. 7-9.

A few specimens of this shell have been collected at Thedford and Ravenswood by the Rev. Hector Currie, and at Thedford by Mr. Kernahan, but the species seems to have been first recognized in Canada by Mr. Schuchert.

CAMAROTECCHIA THEDFORDENSIS. (Nom. prov.)

Plate 48, figs. 11, 11a and 11b.

Perhaps a diminutive stratigraphical variety of *Camarotēcchia*

Billingsi, Hall.

Cfr. *Rhynchonella Thalia*, Billings. 1860. Canad. Journ., vol. V., p. 272, figs. 23-25. But not *R. Thalia*, d'Orbigny, 1847.

" " " 1863. Geol. Canada, p. 370, fig. 386.

Rhynchonella (Stenocisma) Billingsi, Hall. 1867. Pal. N. York, vol. IV., p. 336, pl. 54, figs. 9-13.

Camarotēcchia Billingsi, Hall and Clarke. 1893. *Ibid.*, vol. VIII., pt. 2, p. 192, pl. 57, fig. 3.

Shell very similar to the *C. Billingsi* of the Corniferous limestone in general shape and surface ornamentation, but differing therefrom persistently in its much more diminutive size, and more compressed valves. The largest specimens that the writer has seen are three collected at Thedford by the Rev. Hector Currie in 1882, which are of the following dimensions in millimetres. No 1, length 5, breadth 7; No. 2, length 6.5, breadth 6.25; No. 3, length 5.5, breadth 6. Average examples, which appear to be adult, are not quite so large. On the other hand, two of the largest examples of *C. Billingsi* in the Museum of the Survey measure, the one 8.25 mm. in length by 10.75 in breadth, and the other 8 mm. in length by 9.5 in breadth.

Abundant at Thedford, where specimens have been collected by the Rev. Hector Currie, Mr. Kernahan, Mr. Kearney, Mr. Macintosh and Mr. Schuchert.

In a previous list of the fossils of this formation the three specimens collected by Mr. Currie in 1882 were regarded as a small form of *C. Billingsi*, but the subsequent examination and study of more than a hundred and fifty specimens has thrown considerable doubt on the correctness of this conclusion. Under the circumstances it seems desirable to distinguish these little shells by a local and provisional name, as they seem to bear about the same relation to the typical *C. Billingsi* that it does to *C. Horsfordi*, or that *C. Tethys* does to *C. Sappho*.

LEIORHYNCHUS IRIS? Hall.

Cfr. *Leiorhynchus iris*, Hall. 1867. Pal. N. York, vol. IV., p. 360, pl. 56, figs. 41-43.

In 1895, Mr. Schuchert collected, at Thedford, a somewhat imperfect specimen of a small rhynchonelloid shell, which he refers to this species, but with some doubt. This specimen is No. 26,504 of the United States National Museum Catalogue of Invertebrate Fossils, and two similar but more perfect specimens have since been collected by Mr. Kernahan at the same locality. On the ventral valve of each of these specimens there are two distinct longitudinal subangular plications in the sinus and two on each side or six in all, and on the dorsal three well marked plications on the mesial fold and two fainter ones on each side, or seven in all. None of these plications extend quite to the beak. Hall's description of *L. iris* does not give the number of plications on either valve, but, if his figures of that species are correct, there would appear to be ten or twelve plications on the ventral valve and ten on the dorsal.

PUGNAX KERNAHANI. (N. Sp.)

Shell very small for the genus, varying in marginal outline from subovate and a little longer than wide, to subpentagonal or nearly circular

and as wide or a little wider than long, strongly convex, some specimens being higher or deeper than broad, most prominent on the dorsal side anteriorly, subtrigonal in a full edge view, and truncated in front.

Ventral valve shallower than the dorsal, regularly convex in the umbonal region and for about one half its length, but impressed anteriorly with a rather short mesial sinus which is bounded on each side by a short subangular ridge. At the front margin of this valve the mesial portion is prolonged and bent abruptly inward, and the lateral portions are minutely serrate or denticulate, there being apparently three minute denticles on each side of the sinus. Beak of the ventral prominent, acute, and but slightly incurved, the deltidium apparently longer (or higher) than wide.

Dorsal valve faintly plicated in the median line anteriorly, the fold being longitudinally depressed in the middle and bounded on each side by a short subangular longitudinal groove, which widens outward and is followed by a short subangular lateral plication.

In addition to the coarser markings already described, the surface is ornamented with fine lines of growth which are too small to be visible without the aid of a lens. Over most of the surface, they are comparatively few and distant, but close to the anterior margin they are very numerous and densely crowded.



FIG. 3. *Pugnax Kernahani*. *a*, Dorsal view,—*b*, edge view,—and *c*, front view, of an adult specimen, in outline and of twice the natural size.

Characters of the interior of the valves unknown.

Dimensions of the largest specimen known to the writer: maximum length 6.5 mm.; greatest breadth, 5.4 mm.; maximum height or depth, 6.1 mm.

A few specimens of this small and evidently very distinct ribless species have recently been collected at Thedford by Mr. Kernahan and Mr. Macintosh, who have kindly presented three to the Museum of the Survey, and by Mr. Schuchert.

CYCLORHINA NOBILIS, Hall.

- Rhynchospira nobilis*, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 83.
Trematospira ? nobilis, Hall. 1867. Pal. N. York, vol. IV., p. 412, pl. 63, figs. 33—36.
Retzia (Trematospira) nobilis, Whiteaves. 1887. This volume, (advance sheets), p. 116.
Cyclorhina nobilis, Hall and Clarke. 1893. Pal. N. York., vol. VIII, pt. 2, p. 207, pl. 61, figs. 1—12.

This fine species, which is not uncommon in the neighbourhood of Thedford, is the type of Hall and Clarke's genus *Cyclorkina*, published in 1893.

EUNELLA HARMONIA, Hall.

Terebratula harmonia, Hall. 1867. Pal. N. York, vol. IV., p. 388, pl. 60, figs. 11-16.

" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 154, pl. 17, figs. 1-4.

Eunella harmonia, Hall and Clarke. 1893. Pal. N. York, vol. VIII, pt. 2, p. 290, pl. 80, figs. 33-35.

"Middle third of the section at Bartlett's Mills," C. Schuchert, 1895: three specimens which Mr. Schuchert identifies with this species, and which the writer has had the opportunity of studying.

EUNELLA SIMULATOR, Hall.

Terebratula simulator, Hall. 1867. Pal. N. York, vol. IV., p. 391, pl. 60, figs. 69-70.

Eunella simulator, Hall. 1893. Rep. St. Geol. N. York, vol. II., p. 862, fig. 496; and pl. 52, fig. 29; also fig. 24 of expl. of that plate.

Terebratula (Eunella) simulator, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 290, fig. 209.

Eunella simulator, Hall and Clarke. 1894. Ib., pl. 80, fig. 27, and expl. of that plate.

The original description and figures of this species were based upon a "specimen received from Dr. Rominger, collected in the Hamilton group at Widder, Canada West," or, as it is now called, at Thedford, Ontario. *E. simulator* would seem to be quite a rare shell, as it has not been recognized by the writer in any of the Survey collections, nor in any of the local collections at Thedford, and Mr. Schuchert did not find it at that locality nor at Bartlett's Mills.

EUNELLA ATTENUATA. (N. Sp.)



FIG. 4. *Eunella attenuata*. *a*, Dorsal, and *b*, edge view, of an adult specimen, in outline and of twice the natural size.

Shell elongated, compressed, the maximum thickness through the closed valves being little more than one half of their greatest breadth, narrowly

subovate, longer than broad and broadest in advance of the midlength, but concavely and shallowly emarginate in the middle in front (when adult), and attenuate behind, the marginal outline being quite petaloidal.

Ventral valve with a straight, erect slender beak, which is subangular on each side, its apex truncated and perforated, its deltidial area narrow and bounded by two slightly divergent lines. Dorsal valve a little shorter posteriorly than the ventral, with a slightly smaller and entire incurved beak.

Surface practically smooth, though concentric lines of growth are visible in some specimens when examined with a lens: shell structure minutely punctate. Characters of the interior of the valves unknown.

Dimensions of an apparently adult specimen: maximum length, 10.8 mm.; greatest breadth, 7.0 mm.; maximum thickness, 3.8 mm.

Apparently not very uncommon at Thedford and Bartlett's Mills, in the "Middle third of the section." Specimens in the Museum of the Survey were collected at one or other of these localities by the Rev. Hector Currie and Rev. J. M. Goodwillie in 1882, and by Mr. Kernahan in 1896. The writer is informed by Mr. Schuchert that he has seventeen specimens of this species from these localities.

CRANÆNA ROMINGERI, Hall.

- Terebratula Romingeri*, Hall. 1863. Sixteenth Rep. N. York St. Cab. Nat. Hist., p. 48, figs. 22 & 23.
Terebratula Romingeri, Hall. 1867. Pal. N. York, vol. IV., p. 389, pl. 60, figs. 17-25, 66 & 67.
 " " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 155, pl. 16, figs. 20-22.
Cranæna Romingeri, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 297, fig. 215; and pl. 80, figs. 13-19.

Same horizon and localities as for the last species. It seems to be rather abundant at Thedford, where it was first recognized by Mr. Schuchert.

TROPIDOLEPTUS CARINATUS, Conrad. (Sp.)

- Strophomena carinata*, Conrad. 1839. Third Ann. Rep. N. York Geol. Surv., p. 64.
Tropidoleptus carinatus, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 151, figs. 1 & 2; & (1859) Twelfth do., p. 31, figs. 1-4.
 " " Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, fig. 672.
 " " Hall. 1867. Pal. N. York, vol. IV., p. 407, pl. 62, figs. 2 & 3.
 " " Meek and Worthen. 1868. Geol. Surv. Illinois, vol. III, p. 427, pl. 13, fig. 2.
 " " Rathbun. 1874. Bull. Buffalo Soc. Nat. Sc., 1, p. 254, pl. 9, figs. 1, 9, 10, 26.

- Tropidoleptus carinatus*, Nettelroth. 1880. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 146, pl. 17, figs. 14 & 15.
 " " A. Ulrich. 1892. Neues Jahrb. für Min., Geol., and Palaeont., Beilageband, VIII., p. 73, pl. 4, figs. 32-34.
 " " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 304, figs. 227 and 228; and pl. 82, figs. 26-30.

A few specimens of this widely distributed brachiopod have recently been collected at Thedford. They are rather similar in shape and sculpture to *Stropheodonta plicata*, which occurs at the same locality and geological horizon, but the latter shell has a long and transversely striated cardinal area and its test is impunctate.

ATRYPA SPINOSA, Hall.

- Atrypa spinosa*, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 200, figs. 1 and 2.
Atrypa dumosa, Hall. 1843. Ibid., p. 271, fig. 1.
Atrypa aspera, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 168.
 " " Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, figs. 671.
Atrypa spinosa, vel *aspera*, Hall. 1867. Pal. N. York, vol. IV., p. 322, pl. 53 A, figs. 1-14, 18, 24 and 25.
Atrypa aspera, Meek. 1868. Trans. Chicago Ac. Sc., vol. I., p. 96, pl. 13, fig. 12.
Atrypa spinosa, Nicholson. 1874. Rep. Pal. Prov. Ontario, p. 80.
 " " Whitfield. 1882. Geol. Wisconsin, vol. IV., p. 333, pl. 26, figs. 7 and 8.
Atrypa aspera, Nettelroth. 1880. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 88, pl. 14, figs. 1-11.
Atrypa reticularis, var. *aspera*, Whiteaves. 1891. This vol., pt. 3, p. 229; and (1892) pt. 4, p. 289.
Atrypa spinosa, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 55, figs. 21 and 22.
 " " Schuchert. 1897. Synopsis. Amer. Foss. Brachiop., p. 156.

A shell which Mr. Billings calls a coarse-ribbed variety of *Atrypa reticularis* is figured as one of the characteristic fossils of the Hamilton formation of Ontario, on page 384 of the "Geology of Canada" (1863), and a single specimen, collected at Thedford by Mr. R. Macintosh in 1895, has been identified with the *A. spinosa* of Hall by Mr. Schuchert. In two previous parts of this volume *A. spinosa* was regarded as synonymous with the *Atrypa reticularis*, var. *aspera* of European paleontologists, but as *A. spinosa* is still regarded as a valid species, the writer has thought it better to retain that name for the present and to give only American references. Thus, the Rev. G. F. Whidborne, in the third part of the second volume of his Monograph of the Devonian Fauna of the South of England, published by the Paleontographical Society in 1893, makes the following remark in reference to *Atrypa aspera* (Schlotheim). "*Atrypa spinosa*, Hall, *A. hystrix*, Hall, and *A. aspera*, v. *occidentalis*, Hall, do not seem to me to be identical with this species, but closely allied." Professors Hall and Clarke, also, in 1895, in their

explanation of Plate 55 of the second part of the eighth volume of the Palæontology of New York, retain the name *Atrypa spinosa* for specimens from the Hamilton formation of that state, though, on page 172 of the same volume they expressly state that "the *A. spinosa* of the Hamilton shales is but an *A. aspera* with the lamellæ enfolded into tubular spines."

SPIRIFERA PENNATA, Atwater. (Sp.)

- Terebratula pennata*, Atwater. 1820. Am. Journ. Sc. and Arts, vol. II., p. 244, pl. 1, figs. 2 and 3.
Delthyris mucronata, Conrad. 1841. Fifth Ann. Rep. Geol. Surv. N. York, p. 54.
 " " Vanuxem. 1842. Geol. N. York, Rep. Third Distr., p. 150, fig. 3.
 " " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 108, figs. 2, 3; p. 205, fig. 3, (non p. 270, fig. 3).
 " Hall. 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., pl. 11, fig. 18.
Spirifer mucronata, Billings. 1856. Canad. Nat. and Geol., vol. I., p. 474, pl. 7, figs. 9 and 10.
Spirifera mucronata, Billings. 1861. Canad. Journ., N.S., vol. VI., p. 201, figs. 59-62.
 " " " 1863. Geol. Canada, p. 386, figs. 424, a-d.
 " " Hall. 1867. Pal. N. York, vol. IV., p. 216, pl. 34, figs. 1-32; and of numerous subsequent American palæontologists.

The law of priority would seem to require the adoption of the specific name proposed by Atwater for this well-known fossil, in 1820, as suggested by Dr. S. A. Miller.

SPIRIFERA EURYTEINES, Owen.

- Delthyris euryteines*, Owen. 1844. Rep. Geol. Expl. Iowa, Wiscons. and Ill., p. 69, pl. 12, fig. 9.
Spirifer euryteines, Owen. 1852. Geol. Surv. Wiscons., Iowa and Minn., p. 586, pl. 3, figs. 2 and 6.
Spirifer parryana, Hall. 1858. Geol. Surv. Iowa, vol. I., pt. 2, p. 509, pl. 4, fig. 8.
Spirifer capax, Hall. 1858. *Ibid.*, p. 520, pl. 7, fig. 7.
Spirifera Parryana, Billings. 1861. Canad. Journ., vol. VI., p. 261, figs. 77 and 78.
 " " " 1863. Geol. Canada, p. 386, fig. 422.
Spirifera fornacula, Meek and Worthen (non Hall), 1868. Geol. Surv. Ill., vol. III., p. 433, pl. 13, fig. 8.
Spirifera Parryana, Hall. 1883. Second Ann. Rep. N. Y. St. Geologist, pl. 52, figs. 8 and 9.
Spirifera capax, Hall. 1883. *Ibid.*, pl. 52, figs. 15-17.
 ? *Spirifera Parryana*, Walcott. 1894. Palæont. Eureka Distr. Nevada, p. 137, pl. 14, fig. 10.
Spirifera Parryana, Calvin. 1888. Bull. Lab. St. Univ. Iowa, p. 19.
Spirifer Parryanus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 29, 31, 39, pl. 22, figs. 8, 9, 15-17.
Spirifer eurYTEINES, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 389.

E. Billings says (*op. cit.*, 1861) that a single specimen of *S. Parryana* was collected by Mr. C. Robb in the Hamilton shales at Lowe's Mill, Township of Bosanquet, but no other specimens of that species have been

found, so far as the writer is aware, by any local collector in the Hamilton formation of Ontario. In the Museum of the Survey there are two specimens labelled with the name of this species, and as having been collected by Mr. Robb near Thedford, but it is doubtful whether either of them is the specimen figured by Mr. Billings. One of them has the surface so much worn that the finer surface markings are obliterated, and the other looks as if it had been treated with acid. Either of them might as well be referred to *Spirifera granulosa* (Conrad) as to *S. Parryana*.

SPIRIFERA AUDACULA, Conrad. (Sp.)

- Delthyris audacula*, Conrad. 1842. Journ. Ac. Nat. Sc. Philad., vol. VIII., p. 202.
Delthyris medialis, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 208, fig. 8.
Spirifer Eatoni, Hall. 1857. Tenth Rep. N.Y. St. Cab. Nat. Hist., p. 157.
Spirifer medialis, Hall. 1857. *Ibid.*, p. 161, fig. 1.
Delthyris medialis, Rogers. 1858. Geol. Pennsylv., vol. II., pt. 2, p. 828, fig. 609.
Spirifera medialis, Hall. 1867. Pal. N. York, vol. IV., p. 227, pl. 38, figs. 1-25.
Spirifera medialis, var. *Eatoni*, Hall. 1867. *Ibid.*, pl. 38, figs. 12-18.
Spirifera audacula, Whitfield. 1882. Geol. Wisconsin, vol. IV., p. 329, pl. 25, figs. 25 and 26.
Spirifera medialis, Hall. 1883. Second Ann. Rep. N.Y. St. Geologist, pl. 54, figs. 1-13.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 125, pl. 26, figs. 2-5.
Spirifer audaculus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 29, 30 and 31, pl. 24, figs. 1-13; and pl. 29, fig. 5.

Two large ventral valves, which appear to be referable to this species, were collected at Bartlett's Mills by Dr. H. M. Ami in 1883, and more recently, two small but perfect specimens of the same shell have been collected at Thedford, one by the Rev. Hector Currie and the other by Mr. Kernahan.

SPIRIFERA DIVARICATA, Hall.

- Spirifer divaricata*, Hall. 1857. Tenth Rep. N.Y. St. Cab. Nat. Hist., p. 133.
Spirifera divaricata, Hall. 1867. Pal. N. York, vol. IV., p. 213, pl. 32, figs. 1-6.
" " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 113, pl. 11, figs. 6-11; pl. 12, figs. 5-11.
Spirifer divaricatus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 24, 27, 39, pl. 38, figs. 15-17.

Thedford, G. Kernahan, 1897: one large and characteristic specimen which he has kindly presented to the Museum of the Survey.

DELTHYRIS CONSOBRINA, d'Orbigny. (Sp.)

- Delthyris ziczac*, Hall (non Roemer). 1843. Geol. N.Y., Rep. Fourth Distr., p. 200, fig.
Spirifera consobrina, d'Orbigny. 1850. Prodr. Paléont., vol. I., p. 98.
Spirifera ziczac, Hall. 1867. Pal. N. York, vol. IV., p. 222, pl. 35, figs. 15-23.

- Spiriferina ? ziczae*, Whitfield. 1882. Geol. Wisconsin, vol. IV., p. 332, pl. 25, figs. 23 and 24.
Spirifer ziczae, Hall. 1883. Second Ann. Rep. N. York St. Geologist, pl. 50, fig. 9 and pl. 60, fig. 18.
Spirifer consobrina, Miller. 1889. N. Amer. Geol. and Paleont., p. 372.
Spirifer ziczae, Whitfield. 1891. Annals N. York Acad. Sc., vol. V., p. 554, pl. 11, fig. 13.
" " " 1895. Geol. Ohio, vol. VII., p. 448, pl. 7, fig. 13.
Spirifer consobrinus, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 34, figs. 9-18; and pl. 37, figs. 9 and 10.
Delthyris consobrina, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 206.

A few specimens of this shell were collected at Thedford, in the "Middle third of the section," by Mr. Schuchert and Mr. Kernahan in 1895, but the species was first recognized at this locality by Mr. Schuchert.

RETICULARIA FIMBRIATA, Conrad. (Sp.)

- Delthyris fimbriatus*, Conrad. 1842. Journ. Acad. Nat. Sc. Philad., vol. VIII., p. 263.
" " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 208, fig. 10.
Spirifer fimbriatus, Hall. 1858. Geol. Surv. Iowa, vol. I., pt. 2, p. 505, pl. 4, fig. 5.
" " Billings. 1861. Canad. Journ., vol. VI., p. 257, figs. 68-70.
" " " 1863. Geol. Canada, p. 372, fig. 393.
Spirifer fimbriata, Hall. 1867. Pal. N. York, vol. IV., p. 214, pl. 33, figs. 1-11.
Spirifer compactus, Meek. 1868. Trans. Chicago Acad. Sc., vol. I, p. 102, pl. 14, fig. 11.
Spirifer (Martina) Richardsons, Meek. 1868. *Ibid.*, p. 104, pl. 14, fig. 2.
Spirifer fimbriata, Hall. 1883. Second Ann. Rep. N. Y. St. Geol., pl. 61, figs. 17-22.
Spirifer Conradana, S. A. Miller. 1883. Ann. Paleoz. Foss., 2nd. Ed., p. 372.
Spirifer (Martina) undifera, Walcott. 1884. Mon. U.S. Geol. Surv., vol. VIII., pl. 3, figs. 3-6; and pl. 14, fig. 11.
Spirifer Conradana, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 110, pl. 7, figs. 11-13.
Spirifer (M.) Richardsons, Whiteaves. 1891. This volume, pt. 3, p. 226; and (1892) pt. 4, p. 287, pl. 37, fig. 7.
Spirifer fimbriata, Whiteaves. 1892. This volume, pt. 4, p. 286.
Spirifer fimbriatus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, pp. 17, 20, 21, 33 and 37, pl. 36, figs. 17-22; and pl. 38, figs. 9 and 10.
Reticularia fimbriata (Conrad) Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 342.

With the exception of the last reference, the foregoing list of synonyms, with references, though differently arranged, is quoted from Mr. Schuchert's excellent and most useful "Synopsis of American Fossil Brachiopoda," published as "Bulletin of the United States Geological Survey, No. 87." On page 342 of that publication, the following observations are made on *R. fimbriata*: "Mr. Walcott is correct in regarding this species the same as *Spirifer undiferus*, Roemer. Conrad's species, however, was published in 1842, while that of Roemer is two years later, or in 1844. *S. Richardsons* is a young specimen of *S. compacta*, which Mr. Walcott has shown to be a synonym for *S. undiferus*."

ATHYRIS SPIRIFEROIDES, Eaton. (Sp.)

- Terebratula spiriferoides*, Eaton. 1831. Am. Journ. Sci. and Arts, vol. XXI., p. 137.
 " " " 1832. Geological Text-book, p. 46.
Atrypa concentrica, Conrad. 1838. Ann. Rep. Geol. Surv. New York, p. 111.
 " " Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 198, fig. 5.
Spirifer spiriferoides, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 153, figs. 1 and 2.
Athyris spiriferoides, Hall. 1860. Thirteenth do., p. 93, figs. 1-4.
Spirigera concentrica, Billings. 1861. Canad. Journ., vol. VI., p. 145, figs. 54 and 55; and p. 146, figs. 56 and 57.
Athyris spiriferoides, Hall. 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 180, figs. 1-4.
Spirigera concentrica, Billings. 1863. Geol. Canada, p. 373, fig. 379; and p. 385, figs. 421, a-c.
Athyris spiriferoides, Hall. 1867. Pal. N. York, vol. IV., p. 285, pl. 46, figs. 5-31.
Spirigera spiriferoides, Nicholson. 1874. Rep. Pal. Prov. Ont., p. 85.
Athyris spiriferoides, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 80, figs. 60 and 61, and pl. 45, figs. 11-27.

The common *Athyris* or *Meristella* of the Hamilton shales of Ontario was identified with the *A. concentrica* of European authors in 1861 by E. Billings, who called it *Spirigera concentrica*. In 1867 Professor Hall identified Canadian specimens of the same shell with *A. spiriferoides*. Mr. Billings was under the impression that *A. concentrica* was described by Bronn, in 1829, under the name *Terebratula concentrica*, in accordance with the statement made by Bronn himself on page 1233 of the second volume of his "Index Palaeontologicus." Davidson, however, in the synonymy of that species in his monograph of British Devonian Brachiopoda, says that *Terebratula concentrica* was first described by Von Buch in 1839, and definitely accepts that year as the date of its publication. If Davidson's conclusion is correct, it follows that, whether the American fossil be identical with the European species or not, the name *A. spiriferoides* has eight years priority of date over *A. concentrica*. Mr. Schuchert thinks that all the small specimens from Thedford and Bartlett's Mills should be referred to *Athyris Fultonensis*, Swallow (= *A. vittata*, Hall) and that only the larger ones are *A. spiriferoides*. Professor Hall says that the spires or spiral coils of the interior of *A. vittata* are quite distinct from those of *A. spiriferoides*, but the writer has never seen any specimen of an *Athyris* from Thedford or Bartlett's Mills in which any portion of the internal spires is visible.

ATHYRIS FULTONENSIS, Swallow. (Sp.)

- Spirigera fultonensis*, Swallow. 1860. Trans. St. Louis Ac. Sc., vol. I., p. 650.
Spirigera minima, Swallow. 1860. *Ibid.*, p. 649.
Athyris vittata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 89.
Spirigera eborca, A. Winchell. 1866. Rep. Lower Peninsula Michigan, p. 94.

- Athyris vittata*, Hall. 1867. Pal. N. York, vol. IV., p. 289, pl. 46, figs. 1-4.
 " " White. 1880. Second Ann. Rep. Indiana Bur. Statist. and Geol., p. 502, pl. 4, figs. 8 and 9.
 " " White. 1881. Tenth Rep. St. Geol. Indiana, p. 134, pl. 4, figs. 8 and 9.
 " " Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., v. 87, pl. 16, figs. 25-32.
 " " Whiteaves. 1892. This volume, pt. 4, p. 228.
 " " Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 90, figs. 62 and 63; pl. 45, figs. 1-5.
 " " Keyes. 1895. Geol. Surv. Missouri, vol. V., p. 90, pl. 41, fig. 1.

See the remarks on the preceding species.

MERISTELLA BARRISI, Hall.

- Meristella Barrisi*, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 84.
 " " 1867. Pal. N. York, vol. IV., p. 304, pl. 49, figs. 5-22.
 " Hall and Clarke. 1893. *Ibid.*, vol. VIII., pt. 2, pl. 43, figs. 25 and 26; and pl. 44, figs. 27-30.

Thedford, G. Kernahan, 1894-97: an unusually large but somewhat imperfect specimen which has been identified with this species by Mr. Schuchert.

PENTAGONIA UNISULCATA, Conrad. (Sp.)

- Atrypa unisulcata*, Conrad. 1841. Fifth Ann. Rep. Geol. Surv. N. York, p. 56.
Pentagonia Peczai, Cozzens. 1846. Ann. Lyc. Nat. Hist. N. York, vol. IV., p. 158, pl. 10, fig. 3.
Rhynchonella unisulcata, Hall. 1857. Tenth Rep. N. Y. St. Cab. Nat. Hist., p. 125.
Athyris unisulcata, Billings. 1860. Canad. Journ., vol. V., p. 279, figs. 39-42.
Goniocaula unisulcata, Hall. 1861. Fourteenth Rep. N. Y. St. Cab. Nat. Hist., p. 101.
Atrypa unisulcata, Hall. 1862. Fifteenth do., pl. 11, fig. 10.
Meristella unisulcata, Hall. 1862. *Ibid.*, pl. 2, figs. 17-25.
Athyris unisulcata, Billings. 1863. Geol. Canada, p. 373, fig. 396.
Meristella (Pentagonia) unisulcata, var. *biplicata* and *uniplicata*, Hall. 1867. Pal. N. York, vol. IV., p. 309, pl. 50, figs. 18-35.
Meristella unisulcata, Whiteaves. 1887. This volume, part 2, p. 115.
 " *unisulcata*, Nettelroth. 1889. Kentucky Fossil Shells, Mem. Kent. Geol. Surv., p. 99, pl. 15, figs. 9-16.
Pentagonia unisulcata, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 80, pl. 42, figs. 22-32.
 " " Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 302. (From which this list of synonyms and references is quoted.)

This species appears to be of rather rare occurrence in the Hamilton and Corniferous formations of Ontario. One specimen of the var. *biplicata* in the Museum of the Survey, is from the Corniferous limestone of Haldimand Co., Ont., where it was collected by Mr. De Cew in 1857.

MOLLUSCA.

PELECYPODA.

ACTINOPTERIA BOYDII, Conrad. (Sp.)

For the synonymy of this species, with references, see part 3 of this volume, p. 239.

A few detached valves of *A. Boydii* were collected by the writer in 1891 on the banks of the Rivière aux Sables at Bartlett's Mills and at Hill No. 4, near Thedford. Similar specimens were obtained by Mr. Schuchert in 1895 at Bartlett's Mills.

LEIOPTERIA RAFINESQUII, Hall.

Leiopteria Rafinesquii, Hall. 1883. Pal. N. York, vol. V., pt. 1, Pl. 3 and Explanations, pl. 15, fig. 11; and pl. 20, figs. 6 and 17.
 " " " 1884. Pal. N. York, vol. V., pt. 1, Lamellibr., pl. 161, pl. 15, fig. 11; pl. 20, figs. 6 and 7; and pl. 88, figs. 27 and 28.

A few years ago the writer was informed by Professor Calvin that he had found a specimen of *L. Rafinesquii* in the Thedford region, and Mr. Schuchert writes that he collected a specimen, which he identifies with this species, in the "Upper third of the section" at Bartlett's Mills. The only *Leiopteria* from the Hamilton formation of Ontario that the writer has seen is a left valve, with only a portion of the posterior wing preserved, from Bartlett's Mills, in the collection of the Rev. Hector Currie, and it looks quite as much like *L. Dekayi*, Hall, as *L. Rafinesquii*.

LIMOPTERA MACROPTERA, Conrad. (Sp.)

Lima macroptera, Conrad. 1838. Ann. Rep. N. York Geol. Surv., p. 117.
Limoptera macroptera, Hall. 1869. Prelim. Notice Lamellibr. Shells, &c., pt. 2, p. 17.
 " " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations: pl. 24, fig. 14; pl. 26, figs. 6-9; pl. 27, figs. 1-10; pl. 28, figs. 4 and 5; and pl. 29, figs. 1-4.
 " " " 1884. *Ibid.*, p. 246, plates as in last reference, but add pl. 92, figs. 4-9.

Mr. Schuchert collected a cast of the interior of an aviculoid shell, which he identifies with this species, in the "Middle third of the section," at Bartlett's Mills in 1895. This specimen, which the writer has examined, is No. 26,492 of the United States National Museum Catalogue of Invertebrate Fossils.

CYPRICARDELLA BELLISTRATA? Conrad.

For a list of the synonyms of this species, with references, see page 308 of this volume.

Three casts of the interior of small shells, which are probably young or small individuals of this species, have recently been collected at Bartlett's

Mills by the Rev. Hector Currie, who has kindly presented two of them to the Museum of the Survey. The maximum length of the largest of the three is only twenty-seven millimetres, and it is not quite certain that they are not very young examples of *C. tenuistriata* (Hall).

A well preserved but rather imperfect specimen of *C. bellistriata*, in the Museum of the Survey, is labelled as having been collected by J. De Cew in 1857 from the Corniferous limestone of Lot 24, Concession 1, Walpole, Ontario.

NUCULA LIRATA, Conrad.

A list of the synonyms of this species is given on page 301.

An imperfect and badly preserved cast of the interior of the closed valves of a small shell which Mr. Schuchert identifies with *N. lirata*, was collected by him at Bartlett's Mills (in the "Lower third of the section") in 1895. The specimen is No. 26,496 of the United States National Museum Catalogue of Invertebrate Fossils.

The "badly preserved single valves" from the north side of Manitoba Island referred to under the name *N. lirata*, on page 301 of the fourth part of this volume, may not belong to the same species nor even to the same genus.

NUCULITES TRIQUETER, Conrad.

- Nuculites triqueter*, Conrad. 1841. Ann. Rep. Geol. Surv. N. York, p. 50.
 " " Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 4.
 " " Hall. 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations :
 pl. 47, figs. 17-24.
 " " Hall. 1885. Ibid., vol. V., pt. 1, Lamellibr. 2, p. 326, pl. 47, figs.
 17-24; and pl. 93, figs. 8-10.

Bartlett's Mills, in the "Lower third of the section", three small but well preserved casts of the interior of the shell, which were collected in 1895, by Mr. Schuchert, who identifies them with this species. The largest is scarcely four millimetres in its maximum length, but in all three the "impression of the curved muscular ridge or clavicle just anterior to the beaks," which is so characteristic of the genus, is remarkably well defined. The specimens are No. 26,498 of the United States National Museum Catalogue of Invertebrate Fossils.

LEDA ROSTELLATA, Conrad. (Sp.)

- Nuculites rostellata*, Conrad. 1841. Geol. Surv. N. York, Ann. Rep., p. 50.
Leda? rostellata, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 5.
Leda (Nuculana) rostellata, Hall. 1883. Pal. N. York, vol. V., pt. 1, Plates and
 Explanations : pl. 47, figs. 45-47.

Leda (Nuculana) perstriata, Hall. 1883. *Ibid.*, pl. 47, figs. 42-44.

Leda rostellata, Hall. 1885. Pal. N. York, vol. V., pt. 1, Lamellibr., 2, p. 330, pl. 47, figs. 42-47.

A few casts of the interior of both valves of a *Leda*, which are so essentially similar to *L. rostellata* in marginal outline and in the size and position of the beaks that they are probably referable to that species, have been collected of late years at Bartlett's Mills by Mr. Kernahan, Mr. Kearney and Mr. Schuchert. Two of these casts are in the Museum of the Survey.

PALEONEILO PLANA, Hall.

Paleoneilo plana, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 7.

" " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations : pl. 48, figs. 21-28.

" " " 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 334, pl. 48, figs. 21-28.

Bartlett's Mills, in the "Lower third of the section," a single specimen (a cast of the interior of the closed valves about nine millimetres in length) which was collected and identified by Mr. Schuchert. This little cast is No. 26,499 of the United States National Museum Catalogue of Invertebrate Fossils.

NYASSA ARGUTA, Hall.

Nyassa arguta, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 28.

" " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations : pl. 53, figs. 9-20.

" " " 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 354, pl. 53, figs. 7-20.

A single specimen, which agrees very well with the description and figures of this species, but which does not show any of the characters of the hinge dentition, was collected at Thedford by Mr. B. E. Walker, of Toronto, in 1896.

PARACYCLAS LIRATA, Conrad. (Sp.)

Posidonia lirata, Conrad. 1838. Rep. Geol. Surv. N. York, p. 116, pl. (no number) fig. 12.

Lucina (Paracyclas) lirata, Hall and Whitfield. 1872. Twenty-fourth Ann. Rep. N. Y. State Mus. Nat. Hist., p. 200.

Paracyclas lirata, Hall. (Pars.) 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations : pl. 72, figs. 1-19.

Paracyclas lirata, Hall. 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 441, pl. 72, figs. 1-19 ; and pl. 95, fig. 19.

Apparently not very uncommon at Bartlett's Mills, where specimens have been collected during the last two or three years by Mr. Kernahan, Mr. Kearney and Mr. Schuchert.

ORTHONOTA PARVULA, Hall.

- Orthonota parvula*, Hall. 1870. Prelim. Notice Lamellibr. Shells, &c., 2, p. 88.
 " " " 1883. Pal. N. York, vol. V., pt. 1, Plates and Explanations:
 pl. 78, figs. 29-32.
Sanguinolites truncatus, Hall. (Pars.) 1883. *Ibid.*, vol. V., pt. 1, Plates and Explanations:
 pl. 65, figs. 1-6.
Orthonota parvula, Hall. 1885. *Ibid.*, vol. V., pt. 1, Lamellibr. 2, p. 422, pl. 65, figs.
 2 and 3; and pl. 78, figs. 29-32.

Bartlett's Mills (in the "Lower third of the section"), C. Schuchert, 1895: a beautifully preserved but very small specimen, not more than four millimetres in its maximum length, which Mr. Schuchert identifies with this species. The specimen is No. 26,501 of the United States National Museum Catalogue of Invertebrate Fossils.

GASTEROPODA.

PLATYOSTOMA TURBINATUM, Hall.

- Platystoma turbinata*, Hall. 1861. Fourteenth Rep. N. Y. St. Cab. Nat. Hist., p. 106.
 " " " 1876. Illustr. Devonian Fossils: Gasteropoda, pl. 10.
 " " " 1879. Pal. N. York, vol. V., pt. 2, p. 27, pl. 9, figs. 12-24.

Mr. Schuchert refers to this species six specimens of a shell collected by Mr. Macintosh and himself at Bartlett's Mills (in the "Lower third of the section") in 1895. These specimens, which the writer has examined and which are No. 26,483 of the United States National Museum Catalogue of Invertebrate Fossils, seem to be intermediate in their characters between *P. turbinatum* and *P. lineatum*.

Since the publication of Hall's "Illustrations of Devonian Fossils" it has become obvious that the fossil from the Corniferous limestone of Port Colborne that Nicholson had previously described and figured (in 1874) under the name "*Helicotoma? serotina*," is most probably a cast of the interior of the shell of a specimen of *P. turbinatum*. In the Museum of the Survey there are a few characteristic examples of the typical form of *P. turbinatum*, collected by J. De Cew in 1857, from the Corniferous limestone of Rama's Farm, near Port Colborne, and of Lot 4, Concession 3, Township of Bertie.

PLEUROTOMARIA CAPILLARIA, Conrad.

- Pleurotomaria capillaria*, Conrad. 1842. Journ. Acad. Nat. Sc. Philad., vol. VIII., p. 271, pl. 16, fig. 11.
 " " " Hall. 1861. New Species of Devon. Fossils, &c., p. 17.
 " " " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 4-5, pl. 5, fig. 2.
 " " " Hall. 1876. Illustr. Devonian Fossils: Gasteropoda, pl. 20,
 " " " " 1879. Pal. N. York, vol. V., pt. 2, p. 77, pl. 20, figs. 18-21.

A small specimen of a shell which Mr. Schuchert identifies with this species was collected by him in 1895 at Bartlett's Mills (in the "Lower third of the section"). This specimen, which is No. 26,485 of the United States National Museum Catalogue of Invertebrate Fossils, is about fourteen lines in length, or height, and has most of the test preserved, although somewhat pyritized. Three specimens of essentially the same size and shape, but with little or no portion of the test preserved, had previously been found, one at Bartlett's Mills by the Rev. Hector Currie, and the others near Thedford by J. Townsend and G. Kernahan.

PLEUROTOMARIA ARKONENSIS. (N. Sp.)

Plate 48, figs. 12 and 12^{1/2}.

Shell depressed turbinate, nearly twice as broad as high and flattened below.

Volutions six, the first four forming a moderately elevated subconical spire, the last two almost step-shaped, and much more rapidly expanding laterally. Outer volution depressed, flattened next to the suture, then sloping obliquely downward, above, and truncated at the periphery: its surface marked by a spiral row of minute rounded tubercles, of uniform size and closely contiguous, above the slit-band, and by a similar row of tubercles below it; the upper row being placed about half way between the suture and the slit-band, and the lower one on the lower or anterior margin of the periphery. Slit-band placed on the outer edge of the apical side of this volution, and bounded by two minute and parallel spiral ridges, the outermost of which constitutes the upper or posterior margin of the periphery. Umbilicus apparently of moderate width in casts of the interior and rather narrow when the test is preserved, but all the specimens that the writer has seen have most of the umbilical surface covered by the matrix.

The foregoing description is based upon two specimens collected at Bartlett's Mills, by Mr. Kernahan, in 1895, both of which are now in the Museum of the Survey. One of these, which is figured, has the test preserved, and the other is a mere cast of the interior of the shell. The former, which is twenty millimetres in its maximum breadth, and about eleven mm. high, has most of the umbilical side covered with the matrix, and the flattening of the base is perhaps abnormal. A worn cast of the interior of a shell, which is probably referable to this species, in the Museum of the Survey, is labelled "Hamilton formation, Township of Plympton, A. Murray," and a similar but unworn cast was found at Thedford, a few years ago, by the Rev. Hector Currie. In each of these casts the outer

portion of the last volution is obliquely flattened above and below, and the volution itself is encircled with four low, obtusely angular spiral ridges, one on each side of the periphery, one about half way between the suture and the upper or posterior margin of the periphery, and one which forms the umbilical margin.

EUOMPHALUS (PHANEROTINUS) LAXUS.

- Euomphalus laxus*, Hall. 1861. Descriptions of New Fossils, etc., p. 26.
 " " " 1862. Fifteenth Rep. N.Y. St. Cab. Nat. Hist., p. 54, pl. 6, fig. 2.
Euomphalus (*Eccuomphalus*?) *laxus*, Hall. 1876. Illustr. Devonian Fossils: Gastropoda, pl. 16, figs. 16-18.
Eccuomphalus comes, Hall. 1876. *Ibid.*, pl. 16, figs. 8 and 9.
Euomphalus (*Phanerotinus*) *laxus*, Hall. 1879. Pal. N. York, vol. V., pt. 2, p. 60, pl. 16, figs. 8, 9, and 16-18.

In the Museum of the Survey there are seven specimens, that are clearly referable to this species, which were collected in the Hamilton formation of the Township of Bosanquet, by Mr. Johnson Pettit, in 1868. Only one of these has any portion of the test preserved, the other six being mere decolled casts of the outer volution of the shell. A fine specimen, with two volutions and most of the test preserved, which is also referable to this species, was collected at Thedford, in 1897, by Mr. R. Mackintosh, who has kindly presented it to the Museum of the Survey.

The specimens from lakes Manitoba and Winnipegosis that are identified with the *Euomphalus annulatus* of Phillips, on page 325 of the fourth part of this volume, and figured on Plate 43, (figs. 1, 1a, & 2) seem to differ from this species only in being much more closely coiled.

LOXONEMA (Species undeterminable).

Two casts of the interior of the shell of a rather slender species of *Loxonema*, labelled simply "Widder," are among the old collections of the Survey, and were probably collected at least thirty years ago. Both of these casts are very imperfect posteriorly, but the more perfect of the two is two inches in length and has four volutions preserved, those of the spire being rather strongly convex, with an oblique suture. Scarcely any vestige of the test is preserved on either, but the cast of the last volution of each is marked by coarse, distant, flexuous, transverse plications. These specimens do not seem to agree very well with Hall's description and figures of any of the species of *Loxonema* from the Hamilton formation, in the second part of the fifth volume of the Paleontology of New York, but come rather close to the *L. pascata* of the Upper Helderberg limestone, and especially to the two specimens represented by figures 11 and 12 of Plate 13 of that volume.

PTEROPODA.

COLEOPRION (?) TENCIS, Hall.

Coleoprion (?) tencis, Hall, 1879. Pal. N. York, vol. V., pt. 2, p. 184, pl. 32 A, figs. 1 and 2.

"In shales of the Hamilton group, associated with *Tentaculites bellulus* at Arkona, Ontario, C. W." Hall (*op. cit.*). For "Arkona," in this quotation, read Bartlett's Mills, near Arkona,—where the species is not very uncommon; and it is most likely that *Tentaculites bellulus* was written inadvertently for *T. attenuatus*.

HYOLITHES ACLIS, Hall.

Hyolithes acelis, Hall. 1876. Illustr. Devonian Fossils: Pteropoda, pl. 27, figs 5, 6, 7, 10 & 11.

" " " 1879. Pal. N. York, vol. V., pt. 2, p. 197, pl. 32, figs. 22-30; & pl. 32 A, figs. 23-25.

Bartlett's Mills, in the "Lower third of the section," C. Schuchert, 1895: a fragment, about six millimetres in length, of the pointed apical end of a specimen, which is identified with this species by Mr. Schuchert. The specimen, which the writer has examined, is No. 26,491 of the United States National Museum Catalogue of Invertebrate Fossils.

CEPHALOPODA.

ORTHOCERAS.

All the Orthocerata from the Hamilton formation of the province that the writer has seen are mere casts of the interior of the shell, with not a vestige of the test preserved, and the small species are represented by very fragmentary specimens. Under these circumstances the following provisional arrangement of the species is suggested.

A. Shell large.

A. 1. Chamber of habitation apparently much longer than the septate portion of the shell.

ORTHOCERAS ANAX, Billings.

Orthoceras Anax, Billings. 1875. Canad. Nat. and Geol., vol. VII, (N. S.), p. 238.

The original description of this species, which is the only one that has been published, is as follows. "Shell about two feet long and from three to three and a half inches in diameter at the aperture. Septa from six to eight in a length of two inches, where the diameter is eighteen lines.

Siphuncle nearly central, cylindrical or nearly so, two lines in thickness where the diameter of the shell is sixteen lines."

"The best specimens in the collection (those from one and a half to two feet in length) show none of the septa except in the five or six inches of the smaller extremity. One only, shows a single septum which is five and a half lines deep where the diameter is two inches and a quarter. In the same locality, and in the same state of preservation, were found a number of fragments in which there are eight or nine septa in a length of four inches, where the diameter is between two and three inches. I think these all belong to the same species."

Mr. Billings does not say whether his types of *O. Anax* are from the Hamilton formation or Corniferous limestone, but several specimens of a large *Orthoceras*, in the Museum of the Survey, which are labelled as having been collected in the Township of Bosanquet by Mr. J. Richardson, in 1855, and by Mr. Johnson Pettit, in 1858, are evidently the originals of the foregoing description. Six of these specimens, which are probably some of the "fragments" referred to, are much too imperfect for specific determination, but five are fine and apparently typical but very badly preserved examples of *O. Anax*. The approximate dimensions of three of these latter is as follows, commencing with the largest. No 1 (which is very slightly curved), total length twenty-one inches, of which between about four inches and three-quarters at the smaller end are distinctly septate; No. 2, total length sixteen inches and three-quarters, of which between three and four inches are septate; and No. 3, total length fourteen inches and a half, of which about two inches are septate. A fourth specimen, which is not more than five inches in length, is also probably the one upon which Mr. Billings based the statement that the siphuncle of *O. Anax* is "two lines in thickness where the diameter of the shell is sixteen lines."

Judging by these five specimens, and by Mr. Billings's description of the species, it would seem that the only distinctive character of *O. Anax* is the apparent length of its chamber of habitation, a character which is not exhibited in any of the Devonian species of *Orthoceras* described and figured by Hall in the second part of the fifth volume of the *Paleontology of the State of New York*, and one which is very possibly due to the imperfect preservation of the specimens.

A. 2. Chamber of habitation much shorter than the septate portion of the shell.

ORTHOCERAS LAMBTONENSE (Nom. prov.)

Plate 49, figs. 1 and 1 a

Shell longicone, increasing very slowly in thickness, and circular in transverse section: chamber of habitation nearly cylindrical, apparently

unconstricted, much shorter than the septate portion; siphuncle almost central, small, and not encircled by an "elevated areola" at the septa (as in *O. Marcellense*, Hall), its elements between the septa unknown: surface markings unknown, though all the casts of the interior that the writer has seen are smooth and entirely devoid of a median central carina.

The most perfect specimen of this species that the writer has seen was collected near Thedford, in 1894, by Mr. Kernahan, who has kindly presented it to the Museum of the Survey. It is slightly imperfect at both ends, and its termination anteriorly is both irregular and indefinite, but its dimensions are approximately as follows: Total length, about seven inches; length of chamber of habitation, from two inches to two inches and a quarter; thickness, at the smaller end twenty-seven millimetres, at the larger forty-eight; number of septa preserved, seventeen; distance between two contiguous sutures, about six mm. and a half at the smaller end and eight mm. at the larger.

The only other specimens that the writer has seen which are clearly referable to this species, are three fairly good ones (two of which have part of the body chamber preserved), and three fragments, collected at Bartlett's Mills by G. Kernahan and C. Schuchert in 1895. All six are now in the United States National Museum, and are No. 26,442 of its Catalogue of Invertebrate Fossils. In one of these specimens the sutures of the septa are as much as nine and ten mm. apart.

The shortness of the chamber of habitation is practically the only character that is relied upon to distinguish this species from *O. Anax*. The former is very similar in shape to *O. Marcellense*, Hall, but that species is described as having an eccentric siphuncle encircled by an "elevated areola," and a median ventral carina on casts of the interior. The specific name for the fossil now under consideration is suggested by the fact that Thedford is in the county of Lambton.

B. Shell small.

B. 1. Siphuncle central, or nearly so.

ORTHOCERAS SUBULATUM (?) Hall.

- Cfr. *Orthoceras subulatum*, Hall. 1843. Geol. Surv. N. York, Rep. Third Distr., p. 148.
 " " " 1861. Descript. New Species of Fossils, etc., p. 49.
 " " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 77.
 " " " 1876. Illustr. Devonian Fossils: Cephalopoda, Expl. of pl. 33.
 " " " 1879. Pal. N. York, vol. V., pt. 2, p. 283, pls. 38, fig. 3; 84, figs. 1, 2, 4, 6-10; and 86, figs. 1 and 2.

The name of *Orthoceras exile*, Hall, was included in a previous list of the fossils of this formation and province on the strength of a statement by Professor H. A. Nicholson, that "fragments of a slender *Orthoceras* which appear to belong to this species, are not rare in the Hamilton formation at Widder." The writer has not seen any of the specimens upon which this opinion was based, but most of the small *Orthocerata* from Thedford and Bartlett's Mills in the Museum of the Survey that have been loaned, for comparison, by local collectors, except those here referred to *Bactrites*, seem to agree better with Hall's latest description and figures of *O. subulatum* than with those of *O. exile*. In the remarks which follow the latest description of *O. exile* it is stated that it differs from *O. constrictum* and *O. subulatum* in its excentric siphuncle and more distant septa. The air chambers of *O. exile*, too, are described as "increasing in depth towards the outer chamber," and as "varying from two or three mm., to five mm., in the length of 100 mm., or about thirty chambers." With the exception of the *Bactrites* and of the two specimens here described as *O. Arkonense*, all the small *Orthocerata* from Thedford and Bartlett's Mills that the writer has seen, have a central or very nearly central siphuncle, about one millimetre in diameter. Some of them are crushed nearly flat, but others, which are undistorted, are circular in transverse section. The depth of the air chambers and consequent distance of the sutures apart, varies from as little as one millimetre throughout, to two or even three millimetres, in different specimens, though it is by no means certain that all these belong to the same species. However that may be, in this respect also they seem to agree better with the description of *O. subulatum* than with that of *O. exile*.

B. 2. Siphuncle eccentric.

ORTHOCERAS EXILE (Hall) Nicholson.

Orthoceras exile (Hall) Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 83.

Widder, Nicholson (*op. cit.*). See the remarks on the preceding species.

ORTHOCERAS ARKONSENSE. (N. Sp.)

Plate 48, figs. 13, 14 and 14 a.

Shell slender, longicone, almost cylindrical, but slightly compressed, so that the outline of a transverse section is broadly elliptical: air chambers, except the three or four next to the chamber of habitation, so deep that the distance between the sutures is greater than the maximum diameter of the tube; siphuncle eccentric, only observed at the septa. Surface markings unknown.

Bartlett's Mills, G. Kernahan, 1894 : the two specimens figured, which he has kindly presented to the Museum of the Survey. The smaller of these (figs. 14 and 14 a) is an undistorted fragment fifteen millimetres in length, and five mm. and a half in its greatest diameter, consisting of two whole air chambers and part of a third. The distance between the posterior septum and the one next to it, in this fragment is nearly seven mm. The larger one, the original of figure 13 on the same Plate, is about forty mm. in length. It is slightly but abnormally compressed, and consists of eight air chambers, the four posterior ones being deep with the septa widely distant, and the four anterior ones shallow with the septa comparatively near together.

The salient features of this species would seem to be the great distance of the septa apart, at a short distance from the body chamber, coupled with the very slender contour of the shell, and its eccentric siphuncle.

BACTRITES (OBLIQUESEPTATUS? var.) ARKONENSIS.

Plate 48, figs. 15, 16 and 16 a.

- Cfr. *Orthoceras obliqueseptatum*, G. and F. Sandberger. 1853. Verstein. Rheinisch. Schichten-syst. Nassau, p. 160, pl. 18, figs. 2, 2 a-c.
" *Bactrites obliqueseptatus*, Hyatt. 1883. Genera of Fossil Cephalopoda (in Proc. Boston Soc. Nat. Hist., vol. XXII.) p. 304.

Shell resembling that of *B. obliqueseptatus* in (1) its small size; (2) its slightly compressed sides and consequently broadly elliptical outline in transverse section; (3) its oblique septa, as viewed laterally; and (4) in its marginal and presumably ventral siphuncle;—and differing therefrom only in the circumstance that the minute sinus of each suture at the siphuncle, which Hyatt calls the ventral sinus, is not developed in the majority of specimens.

Thus, out of about fifty specimens from the Hamilton formation of Ontario that the writer has recently examined with a lens, only some five or six have the ventral sinus distinctly developed. In all the others the sutures are straight and continuous where they pass over the siphuncle. Yet, in the specimen represented, enlarged four times, on Plate 48, figs. 16 and 16a, which consists of ten air chambers, the ventral sinus is distinctly visible on each of the septa. Moreover, the Sandbergers, in their original description of *Bactrites*, say that this sinus, which they call the "dorsal lobe," and regard it, as Hyatt says, as "due to the approximation of the funnels to the side," is sometimes entirely wanting ("*interdum omnino nullus*"). In their representation too (*op. cit.*, pl. 18, fig. 2 e) of the siphonal or ventral side of two of the air chambers of *Orthoceras obliqueseptatum*, magnified, the exposures of the siphuncle at each of the

sutures is so irregular in outline as to be evidently due to minute imperfections or breaks in the casts of the interior, or of the shell wall of these chambers.

This little pyritized *Bartrites* is abundant at Bartlett's Mills, but not quite so common at Thedford. At both of these localities specimens were collected by the Rev. Hector Currie in 1882, and more recently by Messrs. Kernahan, Schuchert, Walker and others. Altogether the writer has seen nearly a hundred of these specimen the largest of which are not quite an inch long. Some of them are casts of the interior of the body chamber, either alone, or with one, two or more of the air chambers attached. In such specimens the body chamber is from nineteen to twenty-three millimetres long, and its dorso-ventral diameter anteriorly averages five mm. Others are casts of considerable portions of the septate end of the shell, sometimes with a small piece of that of the body chamber, and in one of the former fourteen septa can be counted in a fragment that is a little over fifteen mm. in length. Figure 15 on Plate 48 is a composite drawing, the body chamber being drawn from one specimen and the septate portion from another.

NEPHRITICERAS LIRATUS, Hall. (Sp.)

- Gyrogonites liratus*, Hall. 1860. Thirtieth Rep. N. Y. St. Cab. Nat. Hist., p. 104.
" " " 1876. Illustr. Devonian Fossils: Cephalopoda, pl. 57, figs. 5, 6; pl. 58, figs. 1, 2; and pl. 60, figs. 8, 9.
Nautiloides liratus, Hall. 1879. Pal. N. York, Vol. V., pt. 2, p. 407, pl. 57, figs. 3; and pl. 60, figs. 8 and 9.

Two imperfect and badly preserved nautiloid shells in the Museum of the Survey, collected in the Township of Bosanquet, by Mr. Pettit, in 1868, seem to represent a form of this species in which the spiral ribs are rather more numerous than usual. One of these, a cast of the interior of the five last air chambers and of a considerable portion of the chamber of habitation, about 100 millimetres in length and about sixty-three in breadth at the aperture, has from thirty-five to forty spiral ribs. The other, which is a distorted cast of the chamber of habitation of a much larger specimen, about 141 millimetres in length and 103 mm. in breadth at the aperture, shows no indication of any ribs.

In his latest description of *N. liratus*, Hall says that in the typical specimen there are "fourteen revolving ridges over the chambered portion of the shell," and that in another specimen there are "nine strong plications seen on the lateral face of a partially compressed grand chamber." But, in the specimen of *N. liratus* represented by fig. 9 of Plate 60 of the second part of the fifth volume of the Palaeontology of the State of New York, as many as fifteen ribs can be counted in one half of the circumference.

CRUSTACEA.

OSTRACODA.

PRIMITIOPSIS PUNCTULIFERA, Hall. (Sp.)

- Leperditia punctulifera*, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist., p. 92.
Cythere? punctulifera, Nicholson. 1873. Rep. Pal. Prov. Ont., p. 124.
Primitiopsis punctulifera, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI.,
 pp. 3 and 9, pl. 2, figs. 7, *a-b*; 12, *a-b*; and 13, *a-b*.
 " " Jones. 1891. Contr. to Canad. Micro-Paleont., p. 95, pl. 11,
 figs. 10 and 11, *a-b*.

This little species, which is common at Thedford and its vicinity, where it was first recognized by Prof. H. A. Nicholson, is now referred by Professor T. Rupert Jones to his genus *Primitiopsis*.

ULRICHIA CONRADI, Jones.

- Ulrichia Conradi*, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI., p. 544,
 fig. 2.
 " " Jones. 1891. Contr. to Canad. Micro-Paleont., p. 95, pl. 11, fig. 13.

The type of this species is a "small left valve" collected at Thedford, by Dr. G. J. Hinde.

BARYCHILINA WALCOTTI, Jones.

- Primitia (?) Walcottii*, Jones. 1890. Quart. Journ. Geol. Soc. Lond., vol. XLVI., p.
 543, fig. 1.
Kirkbya (?) Walcottii, Jones. 1891. Contr. to Canad. Micro-Paleont., p. 96, pl. 11, figs.
 12, *a-b*.

In a letter to the writer, dated June 2nd, 1896, Professor Jones states that the proper name for this species, which was based upon a single imperfect valve from Thedford collected by Dr. G. J. Hinde, is *Barychilina Walcottii*.

PHYLLOPODA.

ELYMOCARIS HINDEI, Jones and Woodward.

- Elymocaris Hindei*, Jones and Woodward. 1894. Geol. Mag., N. S., Dec. IV., vol. I.,
 p. 293, pl. 9, fig. 7.

Arkona, Dr. G. J. Hinde: "two valves of a carapace. The right valve is nearly perfect, but has lost a piece off the hinder end, and is somewhat cracked by pressure. The other valve lies obliquely and partly embedded."

TRILOBITA.

PROETUS ROWI, Green.

- Calymene Rowi*, Green. 1838. Amer. Journ. Sc. and Arts, vol. XXXIII., p. 406.
Proetus Rowi, Hall. 1861. Descript. New Species of Fossils, etc., p. 75.
 " " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 103.
 " " " 1876. Illustr. Devonian Fossils, pl. 21, figs. 2-6.
 " " Hall and Clarke. 1888. Pal. N. York, vol. VII., p. 119, pl. 21, figs. 2-6, 24-26; and pl. 23, figs. 20-29.

A few nearly perfect but doubled up specimens of this species have been collected near Thedford, within the last four or five years, by Messrs. Kernahan, Kearney, Schuchert and Walker. One of these has been kindly presented to the Museum of the Survey by Mr. Kernahan.

PROETUS CRASSIMARGINATUS, Hall.

- Calymene crassimarginatus*, Hall. 1843. Geol. N. York, Rep. Fourth Distr., p. 172, fig. 5.
Proetus crassimarginatus, Hall. 1859. Twelfth Rep. N. Y. St. Cab. Nat. Hist., p. 88.
Phillipsia (?) crassimarginata, Billings. 1861. Canad. Journ., vol. VI., p. 362.
Proetus crassimarginatus, Hall. 1861. Descript. New Species of Fossils, etc., p. 72.
 " " " 1862. Fifteenth Rep. N. Y. St. Cab. Nat. Hist., p. 100.
 " " " 1876. Illustr. Devonian Fossils, pl. 20, figs. 20-31.
Proetus Conradi, Hall. 1876. *Ibid.*, pl. 20, figs. 5, 8 and 9.
Proetus crassimarginatus, Hall. 1888. Pal. N. York, vol. VII., p. 99, pl. 20, figs. 6-8, 20-31; pl. 22, figs. 20-26; and pl. 25, fig. 8.

The writer is informed by Mr. Schuchert that he has obtained a perfect specimen of this species from the "Lower third of the section" at Bartlett's Mills.

FISHES.

PTYCTODUS CALCEOLUS, Newberry & Worthen. (Sp.)

- Rinodus calceolus*, Newberry & Worthen. 1866. Paleont. Ill., vol. II., p. 106, pl. 10, fig. 10.
Ptyctodus calceolus, Newberry. 1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 59, pl. 59, figs. 13 and 13 a.

An upper tooth, or rather the tritoral area of an upper tooth, which has been identified with this species by Mr. A. Smith Woodward, was collected at Thedford by the Rev. J. B. Goodwillie, in 1882, and presented by him to the Museum of the Survey. Its maximum length is about thirty-four millimetres. A much smaller but otherwise essentially similar specimen was collected on the Rivière aux Sables, at Hill No. 4, near Thedford, by the writer in 1891.

ASPIDICHTHYS NOTABILIS (?) Whiteaves.

Plate 50, figs. 1 and 2

Cfr. *Aspidichthys notabilis*, Whiteaves. 1892. This volume, pt. 4, p. 354, pl. 47, figs. 1 and 1 a.

Numerous small fragments of the dermal armature of fishes, from Thedford and Bartlett's Mills, with a surface ornamentation very similar to that of the cranial plates of *Macropetalichthys Sullivanti* were identified with that species on page 119 of the second part of this volume. Quite recently, however, the discovery, at Bartlett's Mills, of the two much larger fragments represented on Plate 50, has convinced the writer that the identification of the smaller ones with *M. Sullivanti* is no longer tenable. Both of the specimens figured are quite flat externally and hence clearly are part of the ventral region of the fish, and not of the dorsal or cranial. In both, also, there is a large, longitudinally median, tuberculated area, and, when perfect, both evidently had a broad, smooth, bevelled outer margin on both sides, for the overlap of lateral plates, and hence must have formed part of the median element. The original of fig. 1 on Plate 50 was collected in 1897 by Mr. Kernahan, who has kindly presented it to the Museum of the Survey. In it a portion of the smooth, bevelled surface, on each side of the tuberculated area, is preserved. The specimen represented by figure 2, on the same Plate, was collected by Mr. Kearney, in 1875, and is also in the Museum of the Survey. It is only a large portion of the right side of the plate (as viewed with the ventral surface uppermost) not far from its midlength, with the margin bevelled on the right of the tuberculated area, but in two directions, as if for the overlap of two lateral plates. Both of these specimens are evidently referable to *Aspidichthys* rather than to *Macropetalichthys*, and would seem to have formed portions of the ventromedian plate of a fish which at present can scarcely be satisfactorily distinguished from *A. notabilis*. The specimen collected by Mr. Kernahan (fig. 1) probably represents part of the anterior end of such a plate, though it shows no indication of the transverse, terminal, crescentic bevelled area preserved in the type of *A. notabilis*, and that collected by Mr. Kearney, (fig. 2) seems to be a portion of the right side of a similar plate.

PLATE (OR SCALE), GENUS AND SPECIES INDETERMINABLE.

Plate 50, fig. 3.

The singular plate or scale represented on Plate 50, is labelled "Bosanquet, Range 3, Lot 24," and was evidently collected before the "Geology

of Canada" was published (in 1863), as this particular locality is referred to on page 382 of that volume. The organic part of the specimen is thin, nearly flat, somewhat diamond shaped, but unsymmetrical and unequal sided, with one of the sides deeply and almost angularly concave. Its maximum diameter is twenty-six millimetres, and its surface ornamentation consists of numerous, fine and closely disposed radiating raised lines or minute ridges, which are crossed by equally fine concentric striae or lines of growth.

REVISED LIST OF THE FOSSILS OF THE HAMILTON FORMATION OF ONTARIO.

The arrangement of the species of this list, as in a previous one, is generally in accordance with the classification adopted by Zittel in his *Handbuch der Paläontologie*, but with some exceptions. The crinoids are arranged as in Wachsmuth and Springer's monograph on the Crinoidea Camerata, the polyzoa or bryozoa as in Ulrich's latest "Systematic classification of the Paleozoic Bryozoa,"* the brachiopoda as in Mr. Schuchert's "Synopsis of American Fossil Brachiopoda," and the pelecypoda as in Hall's monograph of the Devonian Lamellibranchiata.†

The authority for the identification is given in the case of a few species that the writer has seen no specimens of, and that have not been previously referred to in this paper.

CCELEENTERATA.

SPONGIÆ.

Receptaculites Neptuni, DeFrance. "Near Widder, Ontario," Dr. G. J. Hinde.
Astræospongia Hamiltonensis, Meek and Worthen.
 Supposed bundles of spicules.
 Supposed *Cliona* borings.

ANTHOZOA.

ALCYONARIA.

Aulopora serpens (Goldfuss ?) Rominger.
Monilopora antiqua, Whiteaves.

* In volume three, part one, of the Final Report of the Geological Survey of Minnesota.

† In volume five of the Paleontology of the State of New York.

ZOANTHARIA.

(A. *Tetracoralla*, Heckel : = *Rugosa*, Edwards and Haimé.)

Microcyclus discus, Meek and Worthen.

Zaphrentis cornicula, Lesueur.

Heterophrentis prolifica, Billings.

Cyathophyllum Zenkeri, Billings.

Heliophyllum exiguum, Billings.

" Halli, Edwards and Haimé.

" juvenc (Rominger).

" tenuisepalum, Billings.

Blothrophyllum conatum (Hall).

Crepidophyllum Archiaci (Billings).

" subcespitosum (Nicholson).

Diphyphyllum strictum (Edwards and Haimé).

Acervularia profunda, Hall.

Phillipsastrea Vernueili, Edwards and Haimé.

Cystiphyllum Americanum, Edwards and Haimé.

" conifolle, Hall.

" superbum, Nicholson.

" vesiculosum, Goldfuss.

(B. *Hexacoralla*, Heckel : = *Tabulata*, Edwards and Haimé.)

Favosites Alpenensis, Winchell.

" arbuscula, Hall.

" Billingsi, Rominger.

" clausa, Rominger.

" placenta, Rominger.

" turbinata, Billings.

Ramaria ramosa, Whiteaves.

Alveolites Goldfussi, Billings.

Striatopora Linneana, Billings.

Cladopora Fischeri (Billings).

" frondosa (Billings).

" Rameri (Billings).

Trachypora elegantula, Billings.

" ornata (= *Dendropora* ornata, Rominger, teste Nicholson).

Syringopora intermedia, Nicholson.

" nobilis, Billings.

HYDROMEDUSÆ.

HYDROIDA.

Clathrodictyon retiforme (Nicholson and Murie).

Stromatopora mamillata, Nicholson.

Stromatoporella granulata, Nicholson.

" incrustans, Hall and Whitfield, sp. (= *Stromatopora* nulliporoides, Nicholson.)

ECHINODERMATA.

CRINOIDEA.

Gilbertocrinus spinigerus (Hall).

Dolatocrinus Canadensis, Whiteaves.

" subaculeatus, Whiteaves.

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N OF ONTARIO.

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Dr. G. J. Hinde.

Survey of Minnesota.

Dolatocrinus. (N. Sp.)

" (Species uncertain.)

Megistocrinus rugosus, Lyon and Casseday.

Gennaeocrinus Arkonensis, Whiteaves.

Arthoacantha punctobrachiata, Williams.

Taxocrinus lobatus (Hall).

Botryocrinus crassus (Whiteaves).

Ancyrocrinus bulbosus, Hall.

BLASTOIDEA.

Pentremites Lycoria, Hall.

Pentremitides filosa, Whiteaves.

Nucleocrinus elegans, Conrad.

Granatocrinus leda (Hall).

Codaster Canadensis, Billings.

Eleutherocrinus Cass. Jayi, Shumard and Yandell.

ASTEROIDEA.

Palaaster eucharis, Hall.

VERMES

Spirorbis angulatus, Hall.

" *Arkonensis*, Nicholson.

" *omphalodes* (Goldfuss) Nicholson.

" *spinuliferus*, Nicholson.

Autodetus Lindstroemi, Clarke.

Ortonia intermedia, Nicholson.

Eunicites alveolatus, Hinde.

" *nanus*, Hinde.

" *palmatus* Hinde.

" *tumidus*, Hinde.

Ænonites compactus, Hinde.

Arabellites politus, Hinde.

" *similis*, var. *arcuatus*, Hinde.

Nereidæus solitarius, Hinde.

Rivière aux Sables, Dr. G. J. Hinde.

MOLLUSCOIDEA.

POLYZOA.

Intrapora cosciniformis (Nicholson).

" *elegantula* (Hall).

Coscinium striatum Hall.

Cystodictya incisurata (Hall).

" *incrassata* (Hall).

" *Meeki* (Nicholson).

" *rectilinea* (Hall).

Semipora bistigmata, Hall.

Tæniopora exigua, Nicholson.

" *penniformis*, Nicholson.

Scalaripora Canadensis, Whiteaves.

- Streblotrypa* Hamiltonensis (Nicholson).
Fenestella Arkonensis, Whiteaves.
 " Davidsoni, Nicholson.
 " filiformis, Nicholson.
 " Nicholsoni, Whiteaves.
Retepora prisca, Nicholson.
Polypora Arkonensis, S. A. Miller.
Ptilopora striata, Hall.
Trematopora carinata, Hall.
Leioclema minutissimum (Nicholson).
Amplexopora Barrandi (Nicholson).
 " moniliformis (Nicholson).
Leptotrypa quadrangularis (Nicholson).
Ceramopora Huronensis, Nicholson.
Fistulipora Romingeri, Nicholson & Foord.
 " subtilis, Hall.
 " utriculus, Rominger.
 " variopora (Hall).
Lichenalia ramosa, Hall.
 " stellata, Hall.
 " subtrigona, Hall.
Pinacotrypa elegans (Rominger).
Botryllopora socialis, Nicholson.
Hederella Canadensis (Nicholson).
 " cirrhosa, Hall.
 " filiformis (Nicholson).
 " magna, Hall.
Ascodictyon fusiforme, Nicholson.
 " stellatum, Nicholson.

BRACHIOPODA.

- Lingula* ligea, Hall.
 " Thedfordensis, Whiteaves.
Orbiculoidea Doria (Hall).
Crania crenistriata, Hall.
Creniella Hamiltoniæ (Hall).
Stropheodonta concava, Hall.
 " demissa (Conrad).
 " inequistriata (Conrad).
 " plicata, Hall.
Leptostrophia perplana (Conrad).
Pholidostrophia Iowensis (Owen).
Leptæna rhomboidalis (Wilckens).
Orthothetes anomalus (A. Winchell).
 " Chemungensis, var. *arctostriatus*, Hall.
 " " var. *perversus*, Hall.
Chonetes carinata (or *coronata*) Conrad.
 " lepida, Hall.
 " lineata, Conrad.
 " scitula, Hall.
 " vicina (Castelneau).
Strophalosia radicans (A. Winchell).
 " truncata? (Hall).

- Productella productoides*? (Murchison).
Orthis (*Rhipidomella*) *Penelope*, Hall.
 " " *Vanuxemi*, Hall.
Pentamerella Pavillionensis? Hall.
Gypidula laeviuscula, Hall.
Camarotoechia Sappho (Hall).
 " *Thefordensis*, Whiteaves.
Leiorhynchus Laura. (= *Rhynchonella Laura*, Billings; and *Leiorhynchus Huronensis*, Nicholson.)
 " *iris*, Hall.
Pugnax Kernahani, Whiteaves.
Cyclorhina nobilis, Hall.
Eunella attenuata, Whiteaves.
 " *harmonia*, Hall.
 " *simulator*, Hall.
Cranena Romingeri, Hall.
Tropidoleptus carinatus, Hall.
Atrypa reticularis, L.
 " *spinosa*, Hall.
Spirifera audacula (Conrad).
 " *divaricata*, Hall.
 " *euryteines*, Owen.
 " *granulosa* (Conrad).
 " *pennata* (Atwater).
 " *subdecussata*, Whiteaves.
Delthyris consobrina (d'Orbigny).
 " *sculptilis*, Hall.
Reticularis fimbriata (Conrad).
Martinia Maia (Billings).
Cyrtina Hamiltonensis, Hall.
Ambocella umbonata (Conrad).
Rhynchospira? *Eugenia* (Billings).
Parazyga hirsuta, Hall. (= *Athyris Chloe*, Billings.)
Athyris Fultonensis (Swallow). Teste C. Schuchert.
 " *spiriferoides* (Eaton).
Meristella Barrisi, Hall.
 " *Haskinsi*, Hall.
 " *rostrata*, Hall.
Charionella scitula, Hall.
Pentagonia unisulcata, Conrad.

MOLLUSCA.

PELECYPODA.

- Pterinea flabellum* (Conrad).
Actinopteria Boydii (Conrad).
Leiopteria Rafinesquii, Hall.
Limoptera macroptera (Conrad).
Microdon (*Cypricardella*) *bellistriatus*? Conrad.
Nucula lirata, Conrad.
Nuculites triquetus, Conrad.
Leda rostellata (Conrad).

Paleoneilo plana, Hall.
Nyassa arguta, Hall.
Grammysia arcuata? Conrad. Var.
Paracyclas lirata (Conrad).
Orthonota parvula, Hall.

GASTEROPODA.

Platyceras carinatum, Hall.
" *dumosum*, var. *rarispinum*.
" *erectum*, Hall.
" *quinquesinuatum*, Ulrich.
Platyceras (*Orthonychia*) *conicum*, Hall.
Platystoma lineatum, Conrad.
" *plicatum*, Whiteaves.
" *Shumardi*. (= *Turbo Shumardi*, de Verneuil.)
" *turbinatum*? Conrad.
Pleurotomaria Arkonensis, Whiteaves.
" *capillaria*, Hall.
Euomphalus (*Phanerotinus*) *laxus*, Hall.
Loxonema. (Species undeterminable.)

PTEROPODA.

Tentaculites attenuatus, Hall.
Coleoprion (?) *tenuis*, Hall.
Hyalolithes aelis, Hall.

CEPHALOPODA.

Orthoceras Anax, Billings.
" *Lambtonense*, Whiteaves.
" *subulatum*? Hall.
" *exile*? Hall.
" *Arkonense*, Whiteaves.
Bactrites (*obliqueseptatus*? var.) *Arkonense*, Whiteaves.
Goniates uniaangularis, Conrad.
Nephriticeras "atus, Hall.

CRUSTACEA.

OSTRACODA.

Primitiopsis punctulifera (Hall).
Ulrichia Conradi, Jones.
Barychilina Walcottii, Jones.

PHYLLOPODA.

Elymocarid Hindei, Jones and Woodward.

TRILOBITA.

Phacops rana, Green.
Dalmanites (Cryphaeus) Boothii, Green.
Proetus crassimarginatus, Hall.
" Rowi (Green).

FISHES.

Ptyctodus calceolus, Newberry and Worthen.
Aspidichthys notabilis? Whiteaves.
Plate, or scale, genus and species uncertain.

GEOLOGICAL SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY

VOLUME I.

BY J. F. WHITEAVES.

APPENDIX

8. *Revision of the nomenclature of some of the species described or enumerated in previous parts of this volume, and additional notes on others, necessitated by the progress of palæontological research.*

PART I.

Page 87.

For "HOLOPARIA ? CANADENSIS, Whiteaves"—and the single reference which follows, read :

LINUPARUS CANADENSIS, Whiteaves.

Hoploparia ? Canadensis, Whiteaves. 1884. Trans. Royal Soc. Canada, vol. II., sect. 4, p. 238.

" " Whiteaves. 1885. This volume, pt. 1, p. 87, pl. 11.

Podocrates Canadensis, Whiteaves. 1896. Trans. Royal Soc. Canada, N. S., vol. I., sect. 4, p. 133.

Linuparus atavus, Ortman. 1897. Amer. Journ. Sc. and Arts, 4th Series, vol. IV., p. 290, and figs. 1, 2 and 3, facing p. 296.

In 1890, Dr. Clemens Schluter, of Bonn, suggested to the writer that the specimen figured on Plate 11 of this volume is clearly a species of *Podocrates*, closely allied to if not identical with *P. Dulmenensis*, as stated in the Transactions of the Royal Society of Canada for 1895.

Still more recently, on receipt of the American Journal of Science for October, 1897, containing a description, with illustrations, of *Linuparus atavus*, the writer was struck with the resemblance of the specimens figured under that name to *Podocrates Canadensis*. In a correspondence which ensued, Dr. Ortman says that he is now fully convinced of the identity of *Linuparus atavus* with *Podocrates Canadensis*, and that the species should be referred to the genus *Linuparus*, which was proposed by Gray, in 1847,* and based upon the recent *Palinurus trigonus* of De Haan. He also says that the genus *Podocrates* was first published by Geinitz in 1850, and that it is founded on a good figure.

*List of the specimens of Crustacea in the British Museum, p. 70.

PART 2.

Page 151.

For "AUCELLA MOSQUENSIS, var. CONCENTRICA," and the list of its synonyms, substitute the following.

AUCELLA CRASSICOLLIS, Keyserling.

- Aucella crassicollis*, Keyserling. 1846. Reise in das Petschora-Land, p. 300, pl. 10, figs. 9-12.
Aucella Piochii, Gabb. 1869 (In part.) Paleont. California, vol. II., p. 194, pl. 32, figs. 92, a-c.
Aucella Piochii, (Gabb) Whiteaves. 1882 (In part.) Trans. Royal Soc. Canada, vol. I., sect. 4, p. 84.
 " " Whiteaves. 1884. Geol. Surv. Canada, Mesoz. Fossils, vol. I., pt. 3, p. 239.
Aucella concentrica, (Fischer) White. 1884. Bull. U. S. Geol. Surv., No. 4, p. 13, pl. 6, figs. 2-12; and (1885) *Ibid.*, No. 15, p. 23.
Aucella Piochii, (Gabb) Whiteaves. 1897 (In part.) Geol. and Nat. Surv. Canada, Ann. Rep. N. S., vol. II., p. 111 A.
Aucella concentrica, (Fischer) White. 1889 (In part.) Mon. U. S. Geol. Surv., No. 13, p. 231, pl. 4, figs. 3-5, 11-17 and 21.
Aucella crassicollis and var. *gracilis*, Lahusen. 1888. Ueber Russischen Aucellen, pp. 24 & 42, pl. 5, figs. 8-16.
Aucella piriformis, Lahusen. 1888. *Ibid.*, pp. 24 & 42, pl. 5, figs. 1-7.
Aucella crassicollis, (Keyserling) Stanton. 1895. Bull. U.S. Geol. Surv., No. 133, p. 45, pl. 5, figs. 1-13; and pl. 6, figs. 1-5.

Since the publication of Lahusen's monograph on the Russian *Aucellæ*, it has become obvious that the specimens which are so abundant at many localities in British Columbia, can no longer be regarded as varieties of *A. concentrica*.

Mr. Stanton, who has examined a series of specimens from that province, expresses the opinion that the *Aucellæ* from the Skagit River, collected by Dr. G. M. Dawson, in 1877, are *A. Piochii*, var. *ovata*, but that those from all the other localities mentioned on pages 151 and 152 of this volume, should be referred to *A. crassicollis*, Keyserling. All the *Aucellæ* that the writer has yet seen from Canadian localities are from a well-defined horizon in the Earlier North American Cretaceous.

Page 156.

For "PLACENTICERAS PEREZIANUM"—read:

DESMOCERAS PEREZIANUM.

And, add to the list of references:

- Desmoceras Perezianum*, Whiteaves. 1892. Trans. Royal Soc. Canada, vol. X., sect. 4, p. 114.

Page 158.

For "PLACENTICERAS (PEREZIANUM? var.) LIARDENSE"—
read :

DESMOCERAS (PEREZIANUM? var.) LIARDENSE.

The systematic position of the four specimens upon which this species was based is still doubtful, and they are now only provisionally referred to *Desmoceras*. Their previous reference to *Placenticeras* was based upon Zittel's extension of the characters of that genus so as to include the Clypeiformes, and has not proved satisfactory.

Page 159.

For "DISCINA PILEOLUS. (N. Sp.)"—read :

ORBICULOIDEA DAWSONI. (Nom. nov.)

Discina pileolus, Whiteaves. 1880. This volume, p. 159, pl. 21, figs. 3 and 3 a, but not *D. pileolus*, Hicks, 1895, which is probably also an *Orbiculoides*.
Discina Dawsoni, Whiteaves. 1893. Trans. Royal Soc. Canada, vol. XI., sect. 4, p. 17.

Page 172.

For "PLACENTICERAS GLABRUM. (N. Sp.)"—read :

DESMOCERAS AFFINE, var. GLABRUM.

Placenticeras glabrum, Whiteaves. 1889. This volume, p. 172, pl. 24, figs. 1 and 1 a-b.
Desmoceras affine, var. *glabrum*, Whiteaves. 1892. Trans. Royal Soc. Canada, vol. X., sect. 4, p. 115, pl. 9.

The type of *Placenticeras glabrum* is a small and perfectly smooth cast of the interior of the shell, collected by Mr. W. Ogilvie, in 1885, from the Cretaceous rocks of the Peace River, a few miles below Fort Vermilion. Numerous other specimens, from rocks of similar age on the Peace River and its tributaries, collected by Mr. McConnell in 1889, were described and figured in the Transactions of the Royal Society of Canada for 1892. As the surface of none of these specimens can be called smooth, or even very nearly smooth, the species was redefined under the name *Desmoceras affine*, on account of its close resemblance to *D. Beudanti*, and the name *glabrum* retained in a varietal sense and restricted to those specimens in which the distant periodic arrests of growth are not developed.

PART 3.

Page 202.

For "CAMPOPHYLLUM ELLIPTICUM"—read :

CYATHOPHYLLUM MCCONNELLI. (N. Sp.)

The reference of the three corals from the Hay River, mentioned on p. 202, to the *Chonophyllum* (*Ptychophyllum*) *ellipticum* of Hall and Whitfield, under the name *Campophyllum ellipticum*, has not proved satisfactory. Professor Calvin, who has recently compared the best of them, the original of Plate 27, fig. 5, of this volume, with Iowa specimens, thinks that it is generically but not specifically identical with Hall and Whitfield's species. Rominger, also, in his Fossil Corals of Michigan, page 104, says that *C. ellipticum* is not a *Chonophyllum* but a *Cyathophyllum* allied to *C. Houghtoni*. Under these circumstances it seems most prudent to distinguish the three Hay River specimens formerly designated as *Campophyllum ellipticum* by the foregoing new specific name, in honour of their discoverer, and to refer them provisionally to the genus *Cyathophyllum*.

Page 204.

"PHILLIPSASTRÆA HENNAHI, Lonsdale."

The corals from the Peace and Hay rivers which were referred to this species, were so identified solely by their external characters. Sections since made shew that they and the specimens from the Hay River referred to *Phillipsastræa Verrillii*, have more the structure of *Pachyphyllum* than of *Phillipsastræa* proper, though Rominger maintains (Fossil Corals of Michigan, page 127) that the separation of these two genera is both "artificial and inappropriate." It is quite likely that all those which have been identified with *Phillipsastræa Hennahei* are mere varieties of *Pachyphyllum Woodmani*, although the specimens from the Hay River have rather smaller and less prominently exerted calyces, with a somewhat smaller number of septa.

Page 205.

"PHILLIPSASTRÆA VERRILLII, Meek. (Sp.)"

See the remarks on the preceding species.

Page 206.

For "PACHYFORA CERVICORNIS, DeBlainville. (Sp.)"—read:

CLADOPORA CERVICORNIS, De Blainville. (Sp.)

Mr. L. M. Lambe, who is making a special study of Canadian Palaeozoic corals, thinks that *Pachypora*, Lindstrom, is synonymous with *Cladopora*, Hall.

Page 207.

For "ALVEOLITES RÆMERI, Billings"—read:

CLADOPORA RÆMERI, Billings. (Sp.)

And, after the paragraph referring to that species, insert the following.

CLADOPORA TURGIDA, Rominger.

Cladopora turgida, Rominger. 1876. Geol. Surv. Michigan, Fossil Corals, p. 48, pl. 19, fig. 2.

A fragment of a specimen from the Ramparts, Mackenzie River, collected by Robert Kennicott, loaned by the U. S. National Museum and labelled No 14,554, has been identified with this species by Mr. Lambe.

Page 216.

For "STROPHALOSIA PRODUCTOIDES, Murchison"—read:

PRODUCTELLA PRODUCTOIDES, Murchison. (Sp.)

And, add to the list of references:

Productella productoides, Hall & Clarke. 1892. Pal. N. York, vol. VIII, pt. 1, p. 317.

Page 217 (and pt. 4, page 283).

PRODUCTELLA SUBACULEATA and its var. CATARACTA.

On page 318 of his recently published Synopsis of American Fossil Brachiopoda, Mr. Schuchert expresses the opinion that "for the present it is preferable to retain the name *P. spinulicosta*" for the American Devonian forms which have been identified with *P. subaculeata*, and its var. *cataracta*. In that publication he includes the specimens referred to un-

der the name *P. subaculeata*, var *cataracta* on page 217, and those identified with the typical form of *P. subaculeata* on page 283, of this volume, in the synonymy of *P. spinulicosta*. On the other hand, it is to be noted that the Rev. G. F. Whidborne, in his Devonian Fauna of the South of England, vol. II., pt. 3 (1893), p. 155, says that *P. spinulicosta* and *P. subaculeata* var *cataracta*, are both varieties of *P. subaculeata*.

Page 222.

For "SPIRIFERA CYRTINÆFORMIS, Hall and Whitfield"—read :

CYRTIA CYRTINÆFORMIS, Hall and Whitfield. (Sp.)

And, add to the list of references :

Cyrtia cyrtinæformis, Hall and Clarke. 1894. Pal. N. York, vol. VIII., pt. 2, p. 42, pl. 25, figs. 26-32.

Page 230.

For "RHYNCHONELLA PUGNUS, Martin"—read :

PUGNAX PUGNUS, Martin (Sp.)

And, add to the list of references :

Pugnax pugnus, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 203, pl. 60 figs. 6-10.

Page 231.

For "RHYNCHONELLA CUBOIDES, Sowerby"—read :

HYPOTHYRIS CUBOIDES, Sowerby. (Sp.)

And, add to the list of references :

Hypothyris cuboides, Hall & Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 200, pl. 60, figs. 49-55.

Professors Hall and Clarke claim that the *Atrypa cuboides* of Sowerby, the *Rhynchonella cuboides* of Davidson and other palæontologists, is the type of McCoy's genus *Hypothyris* as defined by King, and hence that it must be called *Hypothyris cuboides* (Sowerby). Mr. Schuchert, however, who regards *Rhynchonella Emmonsii* as distinct from *R. cuboides*, thinks that the specimens collected by Mr. McConnell on the Hay and Peace rivers are referable to the former rather than to the latter species, and that they should be called *Hypothyris Emmonsii* (Hall and Whitfield).*

* See his "Synopsis of American Fossil Brachiopoda" (1897) p. 233.

Page 232.

For "RHYNCHONELLA CASTANEA, Meek"—read :

HYPOTHYRIS CASTANEA, Meek. (Sp.)

And, add to the list of references :

Liorhynchus castaneus, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pl. 59, figs. 28 and 29.

Hypothyris castanea, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 233.

Page 234.

For "PENTAMERUS GALEATUS, Dalman. Var."—read :

GYPIDULA GALEATA (Dalman). Var.

And, add to the list of references :

Sieherella galeata, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 246, fig. 175, pl. 72, figs. 7-13.

Gypidula galeata, Schuchert. 1897. Synops. Amer. Foss. Brachiop., p. 226.

Page 235.

For "CRYPTONELLA CALVINI ? Hall and Whitfield"—read :

DIELASMA CALVINI ? Hall and Whitfield.

And, add to the synonymy and references :

Dielasma Calvini, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 296, pl. 80, figs. 20-22.

In their remarks upon the genus *Dielasma*, King (op. cit.) Professors Hall and Clarke say : "the *Cryptonella Calvini* of Hall and Whitfield, of the middle Devonian of Iowa, is an excellent representative of the early forms of this genus."

PART 4.

Page 270.

Line 13, from the bottom, for "length" read "breadth."

Page 273.

For "PACHYPORE OR ALVEOLITES. (Sp. Undet.)"—read :

CENITES CRYPTODENS, Billings (Sp.)

Mr. Lambe is of the opinion that all the specimens referred to under the first of these headings, are referable to *Alveolites cryptodens*, Billings, which he thinks is a *Cenites*.

Page 290.

For "PENTAMERUS COMIS, Owen"—read :

GYPIDULA COMIS, Owen (Sp.)

And, add to the list of synonyms and references :

Gypidula comis, Hall and Clarke. 1893. Pal. N. York, vol. VIII., pt. 2, p. 247, fig. 177, pl. 72, figs. 15-24.

Page 291.

For "TEREBRATULA SULLIVANTI, Hall,"—read :

EUNELLA SULLIVANTI, Hall.

And, add the following reference :

Eunella Sullivanti, Hall and Clarke. 1895. Pal. N. York, vol. VIII., pt. 2, pt. 290, fig. 210, pl. 80, figs. 23-26.

Page 331.

For "PLATYOSTOMA TUMIDUM. (N. Sp.)"—read :

PLATYOSTOMA WHITEAVESI, Miller.

Platystoma tumidum, Whiteaves. 1892. This volume, pt. 4, p. 331, pl. 43, fig. 12. But not *Platystoma tumidum*, Meek & Worthen, 1860.

Platystoma Whiteavesi, S. A. Miller. 1897. Second Suppl. N. Amer. Geol. and Palæont., p. 769.

To the list of Pteropoda from the Devonian rocks of Lake Manitoba and Winnipegosis, on pages 342 and 343, add the following :

TENTACULITES PARVULUS. (N. Sp.)

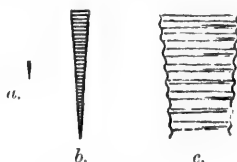


Fig. 5. *Tentaculites parvulus*. a, Side view of a specimen natural size; b, the same enlarged six times; and c, portion of the same, enlarged twenty-four times, to show the surface markings.

Shell (or rather cast of the interior of the shell) very small for the genus, averaging about three, and rarely exceeding three and a half millimetres in length, of the usual narrowly attenuate-conical shape. Surface of the cast marked by very numerous, close-set, minute annulations or transverse raised ridges, which are rather variable in their arrangement and proportionate size. In some specimens, or in different parts of the same specimen, they are either very close-set and uniform in size, or alternately a little larger and a little smaller, or of equal size but not quite so close together. Test unknown.

North side of Manitoba Island, J. B. Tyrrell, September 19, 1897; a flat piece of limestone of irregular shape but (roughly) about five inches by three, with its exposed and weathered surface strewn with numerous specimens of this species, which seems to be well characterized by its very diminutive size and close set, rib-like annulations. The lengths of the smallest of the Devonian species of *Tentaculites* described and figured by Hall in the second part of the fifth volume of the *Palaeontology of the State of New York*, are stated to be as follows: *Tentaculites spiculus*, longest specimens, eight to ten millimetres, ordinary ones, four to six; *T. attenuatus*, ten to twelve mm., rarely a little more; *T. bellulus*, fifteen to twenty-two mm.

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Calvini?

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consobrina

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(sp.)

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Perezianum, var. Liardense

Dimethys

Canadensis

Discina

pilcolus

(sp. indet.)

Dolatoerinus

Canadensis

lamellosus

livatus

subaculeatus

n. sp.

species uncertain

Eatonia

variabilis

Eleutherocerinus

Cassedayi

Elpe

Tyrrellii

Elymocarais

Hindii

Enchodus

Shumardi

Entalis

paupercula

Estheria

bellula

Funella

attenuata

harmonia

simulator

Sullivanti

Eunema

brevispira

clathratulum

speciosum

subspinosum

Euomphalus

(circularis? var.) subtrigonalis

Maskui

Euomphalus (Phanerotinus)

laxus

sp. undet.

Euomphalus (Straparollus)

annulatus

flexistriatus

inops

Exogyra

(sp. indet.)

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arbuscula

Gothlandica (var.)

Fenestella

Arkonensis

Nicholsoni

sp.

vera

Fistulipora

Romingeri

subtilis

utriculus

variopora

Gemmocerinus

Arkonensis

Gervillia

recta

recta, var. borealis

Gilbertocerinus

spinigerus

Glossites

Manitobensis

Gomphoceras

Manitobense

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Goniobasis

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Goniophora

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Grammysia

arcuata? var.

Granatoerinus

Leda

Gypidula

coma

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GYROCERAS

Gyroceras

Canadense

filicinectum

submanillatum

Halobia (Daonella)

Lomineli

occidentalis

Haminea

occidentalis

Hederella

Canadensis

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magna

Heliophyllum

juvencum

parvulum

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*Now called Orthothetes.

†Now written Stropheodonta.

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PLATE XLVIII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

MONILOPORA ANTIQUA (page 364).

- Figure 1. Specimen almost completely enveloping part of a crinoidal column.
- Figure 2. Partially attached specimen, with thin basal expansion and concentrically wrinkled epitheca.
- Figure 3. Portion of a free branch of another specimen.
- Figure 3a. Small piece of the last, three times the natural size, to shew the surface ornamentation.

RÆMERIA RAMOSA (page 367).

- Figure 4. Club-shaped terminal branch, or branchlet, of a specimen of this species.
- Figure 5. Compressed, fan-shaped, terminal branchlet of another specimen.

DOLATOCRINUS SUBACULEATUS (page 369).

- Figure 6. Side view of the calyx of a specimen of this species.
- Figure 6a. Basal view of the same calyx.
- Figure 6b. Two arm bases of the same, four times the natural size, to shew the respiratory slit (n. s.) on one side of each.

GENNEOCRINUS ARKONENSIS (page 373).

- Figure 7. The specimen in the Museum of the Survey referred to on page 374.
- Figure 7a. One of the primary interbrachials of this specimen, six times the natural size, to shew the faint surface markings.

ANCYROCRINUS BULBOSUS (page 375).

- Figure 8. Specimen with the "lateral extensions" at different heights.
- Figure 9. Another specimen with the "lateral extensions" at nearly the same height.

SCALARIPORA CANADENSIS (page 378).

- Figure 10. The larger of the two type specimens from Thedford.
- Figure 10a. Outline of transverse section of the same.
- Figure 10b. Portion of the same, four times the natural size, to shew the apertures of the zoecia.

CAMAROTOECHIA THEDFORDENSIS (page 386).

- Figure 11. Dorsal view of a specimen from Thedford.
- Figure 11a. The same, three times the natural size.
- Figure 11b. Front view of the same specimen, three times the natural size.

PLEUROTOMARIA ARKONENSIS (page 401).

- Figure 12. Apical side of the only testiferous specimen that the writer has seen.
- Figure 12a. Lateral view of the same.

ORTHO CERAS ARKONENSE (page 406).

- Figure 13. Side view of a cast of the interior of eight of the air chambers, shewing the comparative closeness of the four or five septa next to the body chamber and the distance apart of the posterior ones.
- Figure 14. Similar view of a cast of two air chambers and part of a third.
- Figure 14a. Outline of transverse section of the same, shewing the relative position of the siphuncle.

BACTRITES (OBLIQUESEPTATUS? var.) ARKONENSE (page 407).

- Figure 15. A composite figure, the posterior portion being drawn from septate specimens, and the anterior from casts of the body chamber.
- Figure 16. Enlarged view of a cast of the interior of the posterior and septate end of the shell, which shews the ventral sinus distinctly on ten of the septa.
- Figure 16a. Outline of transverse section of the same, also enlarged, and shewing the marginal and presumably ventral siphuncle.

Geological Survey Department, Canada

and the following plates

364).
of a crinoidal column.
expansion and, concentrically

natural size, to shew the surface

37).
of a specimen of this species.
of another specimen.

age 369).

species.

natural size, to shew the respira-

age 373).

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age 375).

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ons" at nearly the same height.

age 378).

Thedford.

size, to shew the apertures of
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es the natural size.

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the air chambers, shewing the
or five septa next to the body
the posterior ones.
nd part of a third.

shewing the relative position of

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ing drawn from septate speci-
of the body chamber.

the posterior and septate end of
sinus distinctly on ten of the

also enlarged, and shewing the
phuncle.

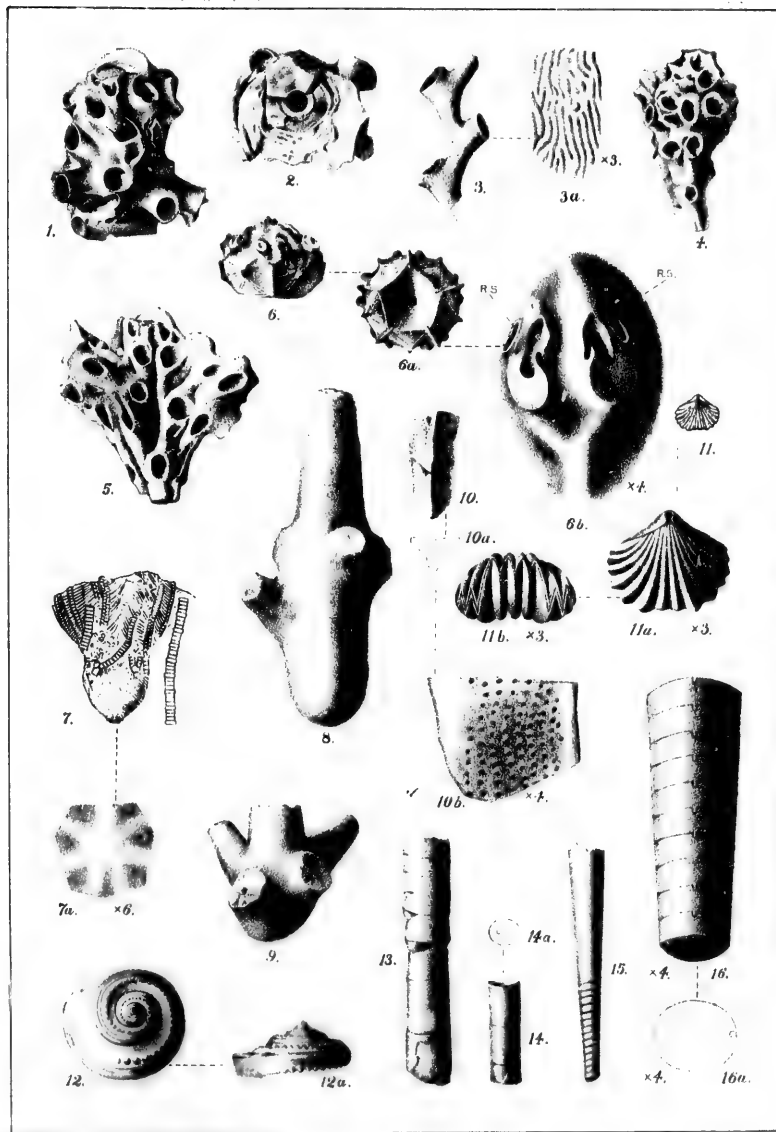


PLATE XLIX.

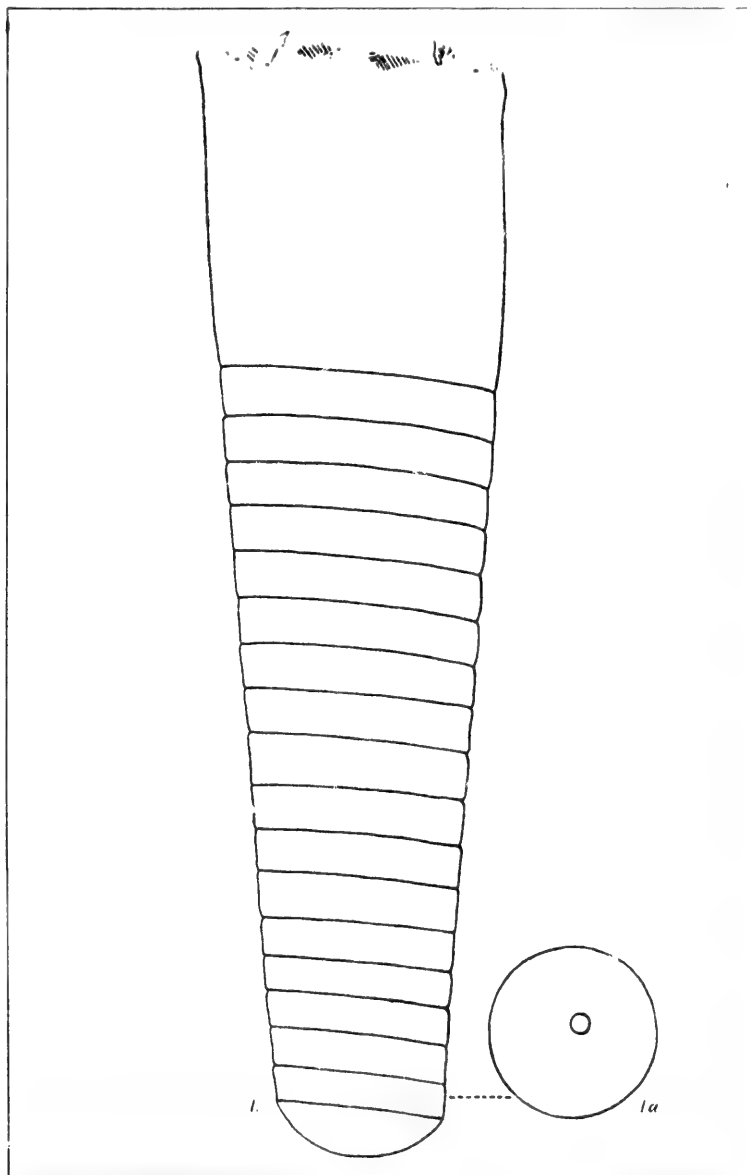
ORTHOCERAS LAMBTONENSE (page 404).

- Figure 1. Side view, in outline, of a cast of the interior of the shell of a specimen of this species, collected near Thedford by Mr. Kernahan and now in the Museum of the Survey.
- Figure 1a. Outline of a transverse section of the same, shewing the almost central siphuncle.

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PLATE XLIX.



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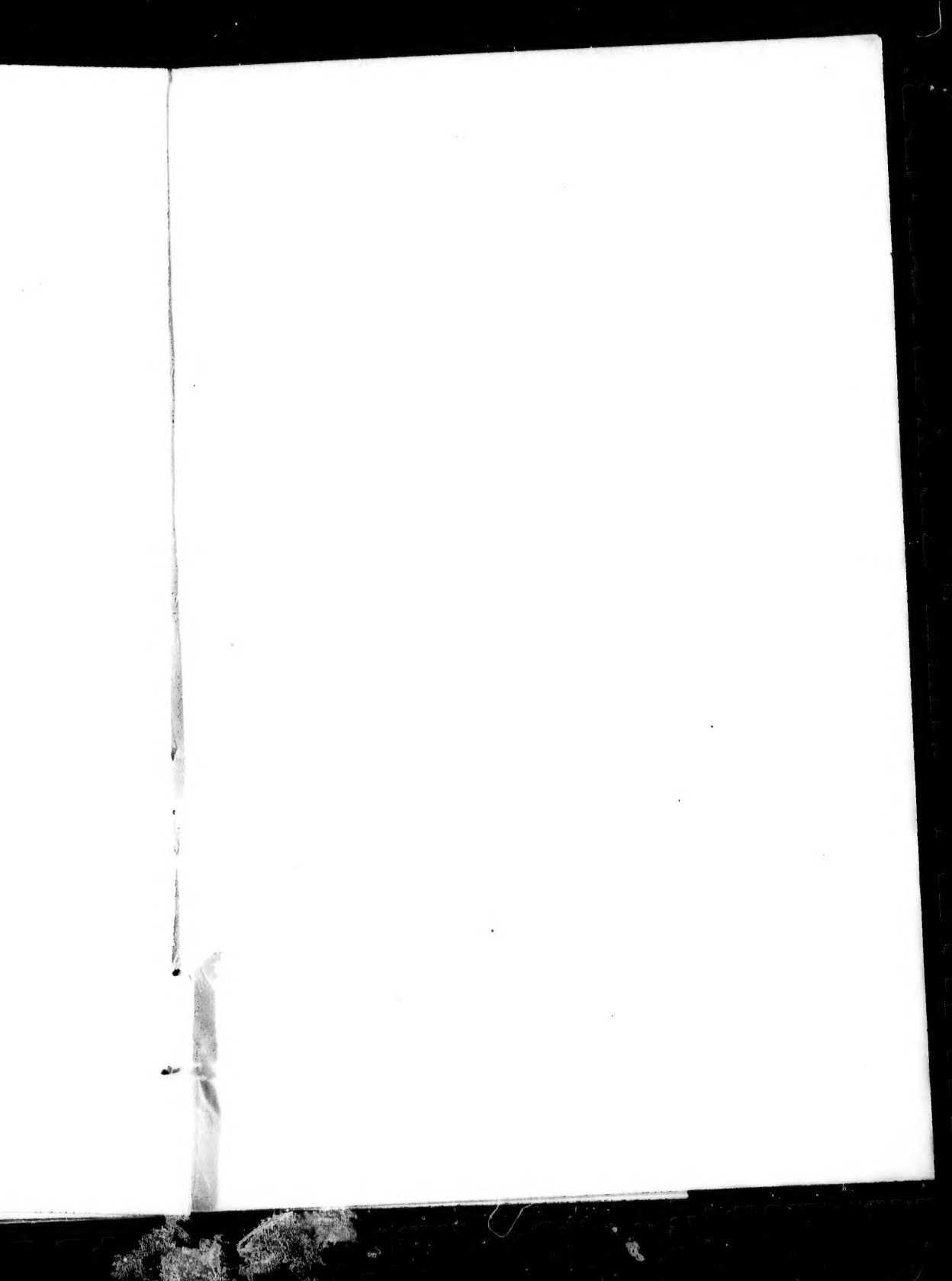


PLATE L.

ASPIDICHTHYS NOTABILIS ? (page 411).

- Figure 1. The specimen from Bartletts Mills collected by Mr. Kernahan.
Figure 2. The specimen from Bartletts Mills collected by Mr. Kearney.

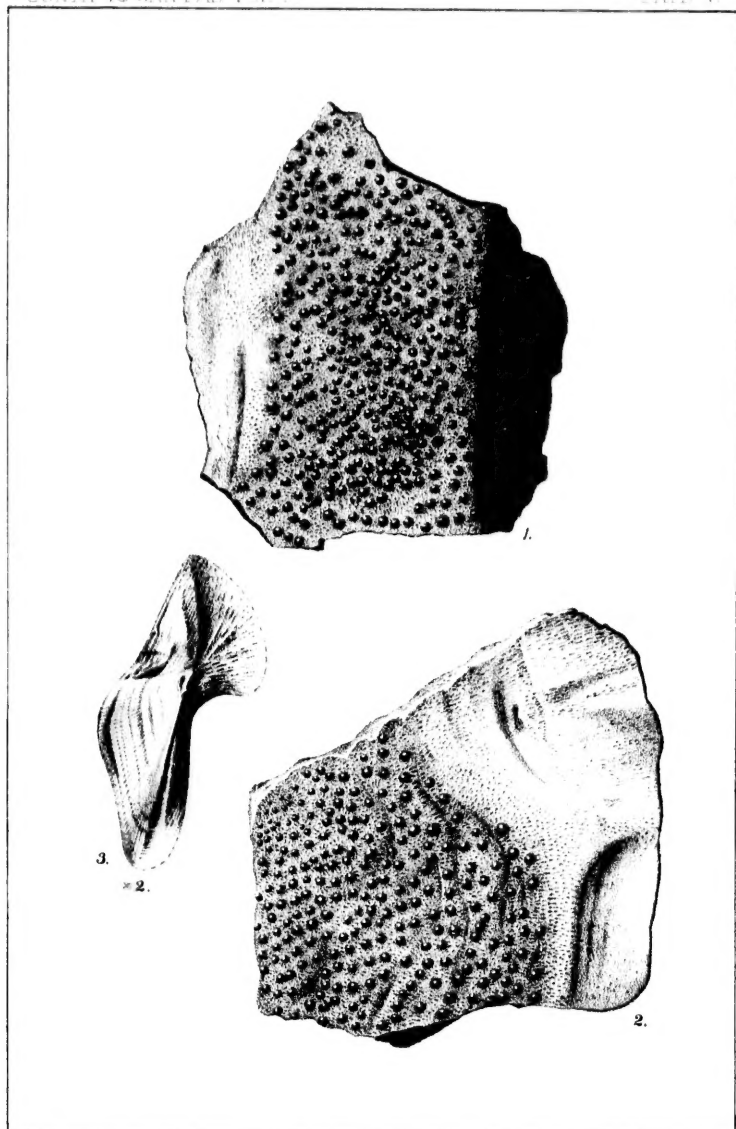
PLATE (OR SCALE) GENUS AND SPECIES INDETERMINABLE (page 411).

- Figure 3. The organic part of the specimen described under this heading, twice the natural size.

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PLATE 1



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